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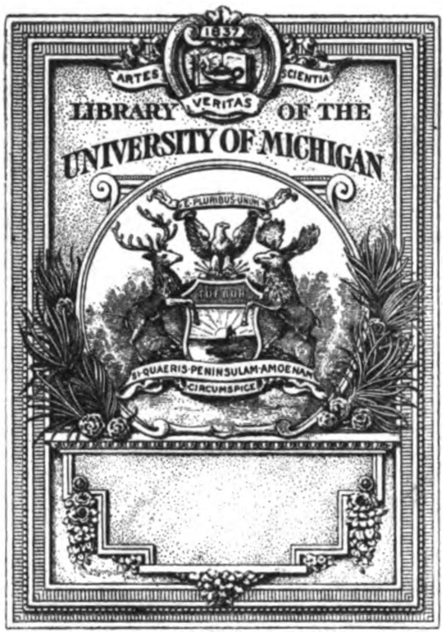
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ELECTRICAL INDUSTRIES

A Monthly Journal Devoted to the Consideration and Advancement of
Electricity in all its Applications

VOLUME IV, 1893

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ELECTRICAL INDUSTRIES.

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Electricity at the World's Columbian Exposition.

Everything in connection with the electrical exhibit at the World's Columbian Exposition is completed so far as arranging detail is concerned, and what now remains to be done is to finish some of the work as laid out, and install the exhibits. With the work so far advanced, we are able to give to the readers of ELECTRICAL INDUSTRIES a good insight into the electrical display that the exposition will offer them, and a review of what has been done.

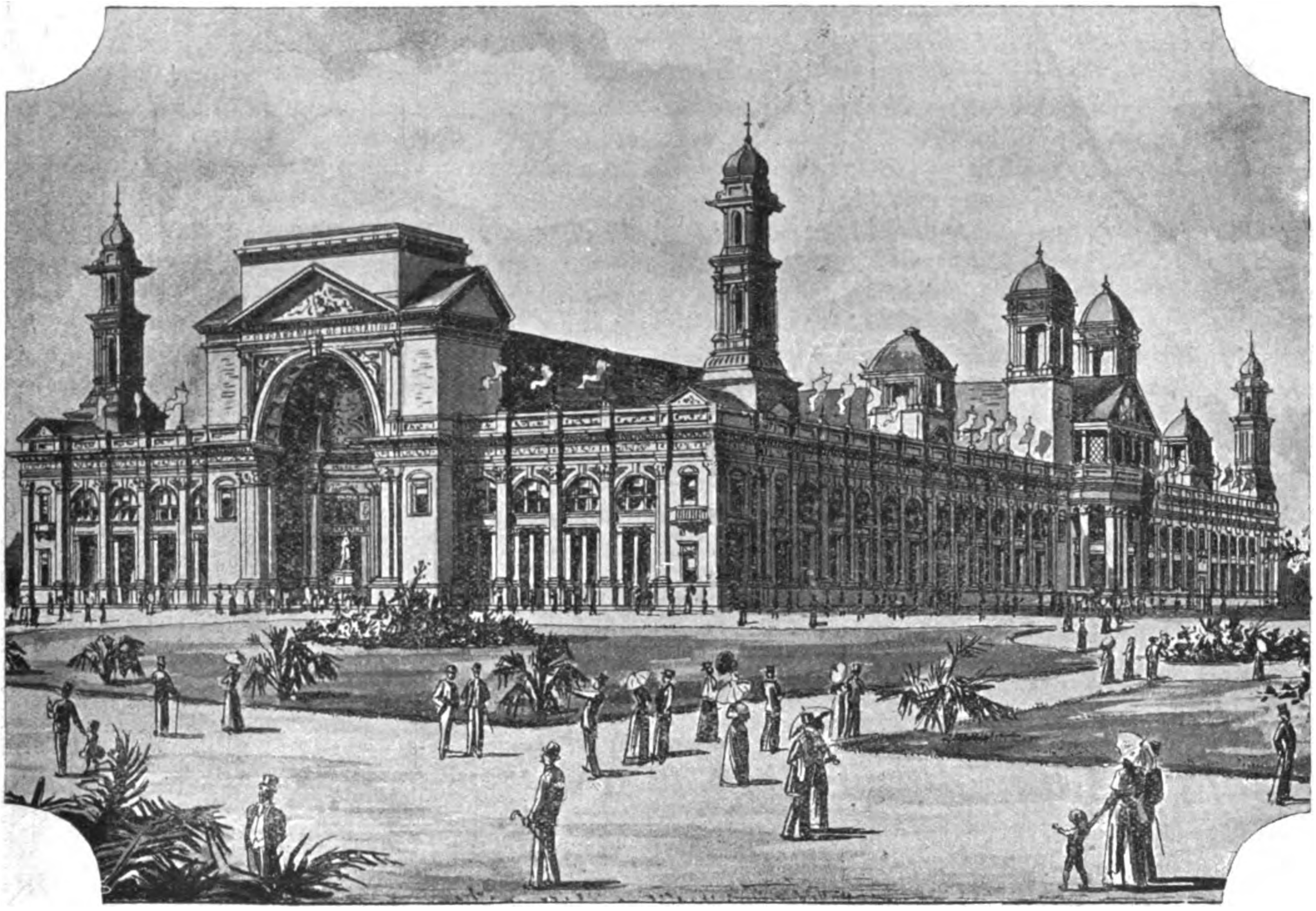


FIG. 1.—ELECTRICITY BUILDING. WORLD'S COLUMBIAN EXPOSITION.

THE DEPARTMENT OF ELECTRICITY.

To the practical worker in the electrical field there will be an immense amount of interest in all the exhibits connected with electrical matters, both the display in the Electrical Building proper, which is shown in the accompanying illustration, and in the power plant, which is to provide the current for supplying the incandescent and arc lighting circuits, but which will be installed in Machinery Hall. This latter is only a part of the electrical exhibit, and is not often referred to in connection with it, as the general impression abroad is that all the electrical exhibits will be installed in the Electricity building. This building it will be remembered has 243,000 square feet of ground floor, and 95,000 of gallery area; but in spite of the fact that so much space is at the command of the department the applications for space ask for three times as much as this.

No department connected with the World's Columbian Exposition has been more skillfully managed than that of electricity. It has had things to contend against that other departments have not had because of the newness of this science. For instance, many manufacturers and dealers in all kinds of quack and fake so-called electrical devices have demanded large space in which to exhibit their goods. In some instances it has been a little difficult to tell just where the genuine left off and the fake began, but the department has been strict in this matter, and although the list of applicants for space which was published in these columns in December contained the names of many such manufacturers, their exhibits will not be accepted.

The allotting of space has been a delicate matter to handle, not only from the fact that three times as much was asked for as could be given, but also because nearly every exhibitor demanded the right to select the space that suited him best. The department has very skillfully evaded all these difficulties, and has already begun the work of installing exhibits. The accompanying diagrams

2 and 3 will show the general arrangement of the building, 2 illustrating the ground floor arrangement and 3 the gallery. Only the lighter apparatus, such as test instruments and small appliances will be shown in the gallery. All heavy exhibits will be on the ground floor. The work of putting in the foundations for the large machinery which will be exhibited in this building is already in hand, and the floor has been marked off showing the position of the various exhibits. The building has received its final coat of paint in the interior, and the department feels that it is to be congratulated upon the forward condition its work has reached. From the present indications it will have the exhibit completed in every respect before the day of opening.

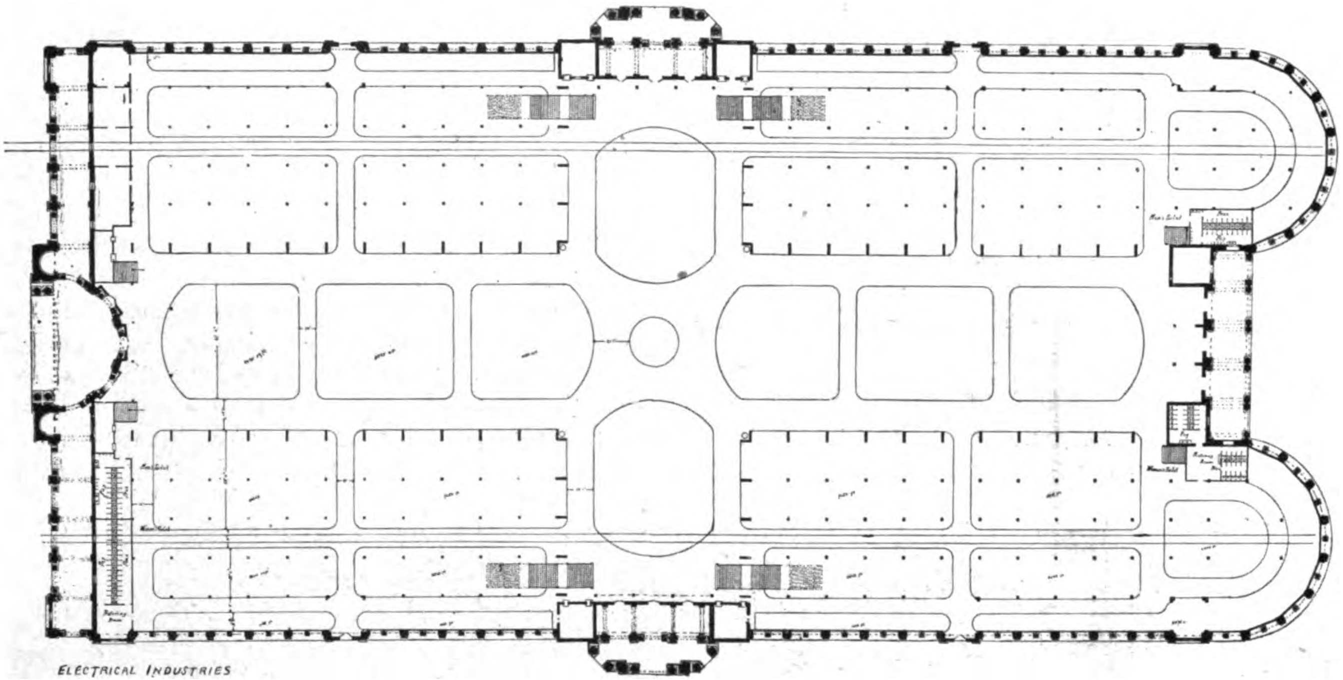


FIG. 2.—ARRANGEMENT OF SPACE ON THE GROUND FLOOR, ELECTRICITY BUILDING, WORLD'S COLUMBIAN EXPOSITION.

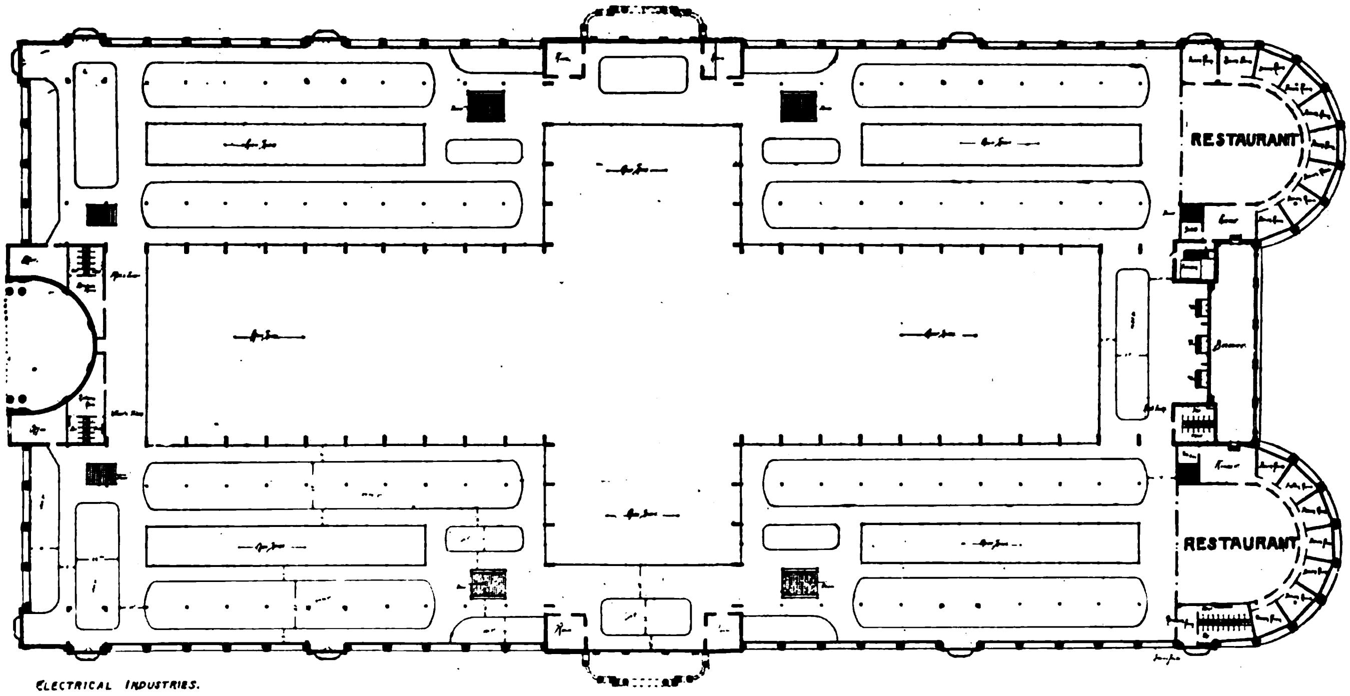


FIG. 3.—ARRANGEMENT OF SPACE IN THE GALLERY, ELECTRICITY BUILDING, WORLD'S COLUMBIAN EXPOSITION.

Prof. J. P. Barrett, chief of the department is too well known to the readers of ELECTRICAL INDUSTRIES to need introduction. He has had general supervision of all that has been undertaken by the department, while his every effort has been ably seconded by the secretary, Dr. J. Allen Hornsby. Dr. Hornsby has been always at home to any one who had anything of interest in connection with the department, and has neglected no opportunity to further the success of the exhibit. The offices of this department are now at the south end of the Electricity building, in the gallery, and comprise a suite of several rooms which will be fitted with every facility for furthering the interests of the department. The space as allotted to several foreign nations in square feet is as follows: Germany, 20,000; Great Britain, 10,000; France, 23,000; Italy, 2,500; Canada, 4,000, while every country has had space assigned to it. From present indications there will be about 1,500 exhibits, not quite two-thirds of them being from this country.

So far as is known to the department every legitimate electrical concern in the country proposes to make more or less of an exhibit, but just what the exhibit will be is not yet stated. During the past year reports have been circulated regarding particularly interesting exhibits that were to be made in the Electricity building, but none of these reports have had the official stamp of the department upon them, but they may perhaps have been inspired by the would-be exhibitor. In regard to the exhibits this much can be said, the latest practice in all the various uses of electricity will be completely shown. The use of electric light for illuminating purposes and artistic effects will of course be the greater attraction of the exhibit in this building, but in all other uses of electricity as complete results comparatively will be shown; thus the transmission of electric power for every conceivable purpose will be fully shown, as will also electric heating in its various phases; and it can be said that no worthy improvement in the way of utilizing electricity will be neglected in the exhibit.

As more of the detail of the conception of the power plant and the electrical exhibit connected with it in Machinery Hall is made public, and the thoroughness with which they will be installed becomes evident, the magnitude of the mechanical part of the Exposition, and of the Exposition itself becomes more apparent. The power plant is so immense that it is difficult to convey any definite idea of its size, for there is nothing to compare it to.

In the accompanying diagram Fig. 5 is shown the general plan of this plant, and the relative positions of the boiler and engine installations. In studying this plant, either part of it is a big subject in itself, being an object lesson which is not only very complete, but which covers its special department very thoroughly.

THE BOILER PLANT.

The building in which the boilers are installed, as will be seen from the diagram, is very long and narrow, its total length being 850 feet. In this enormous length battery after battery of boilers is installed side by side in one long row. There will be altogether between 45 and 50 boilers, all of them of the water tube type, and they will be run under a uniform pressure of 125 pounds to the square inch.

The boilers already contracted for, and some of which are already in operation, and others which are soon to be ready, are as follows, their location being designated by Roman numerals:

Two batteries of two boilers each of the Root type aggregating 1,500-horse power, to evaporate 45,000 pounds of water per hour; location, I.

Two batteries of two boilers each of the Gill type, aggregating 1,500-horse power, to evaporate 45,000 pounds of water per hour; location, II.

Two batteries of four boilers each of the Heine make, aggregating 3,750-horse power, and to evaporate 112,500 pounds of water per hour; location, III.

Two batteries of two boilers each of the National boilers, aggregating 1,500-horse power, and to evaporate 45,000 pounds of water per hour; location, IV.

Five batteries of Campbell & Zell boilers, comprising nine boilers, aggregating 3,750-horse power, to evaporate 112,500 pounds of water per hour; location, V.

Five batteries of two boilers each of the Babcock & Wilcox make, aggregating 3,000-horse power, and to evaporate 90,000 pounds of water per hour; location, VI.

Two batteries of two boilers each of the Stirlin

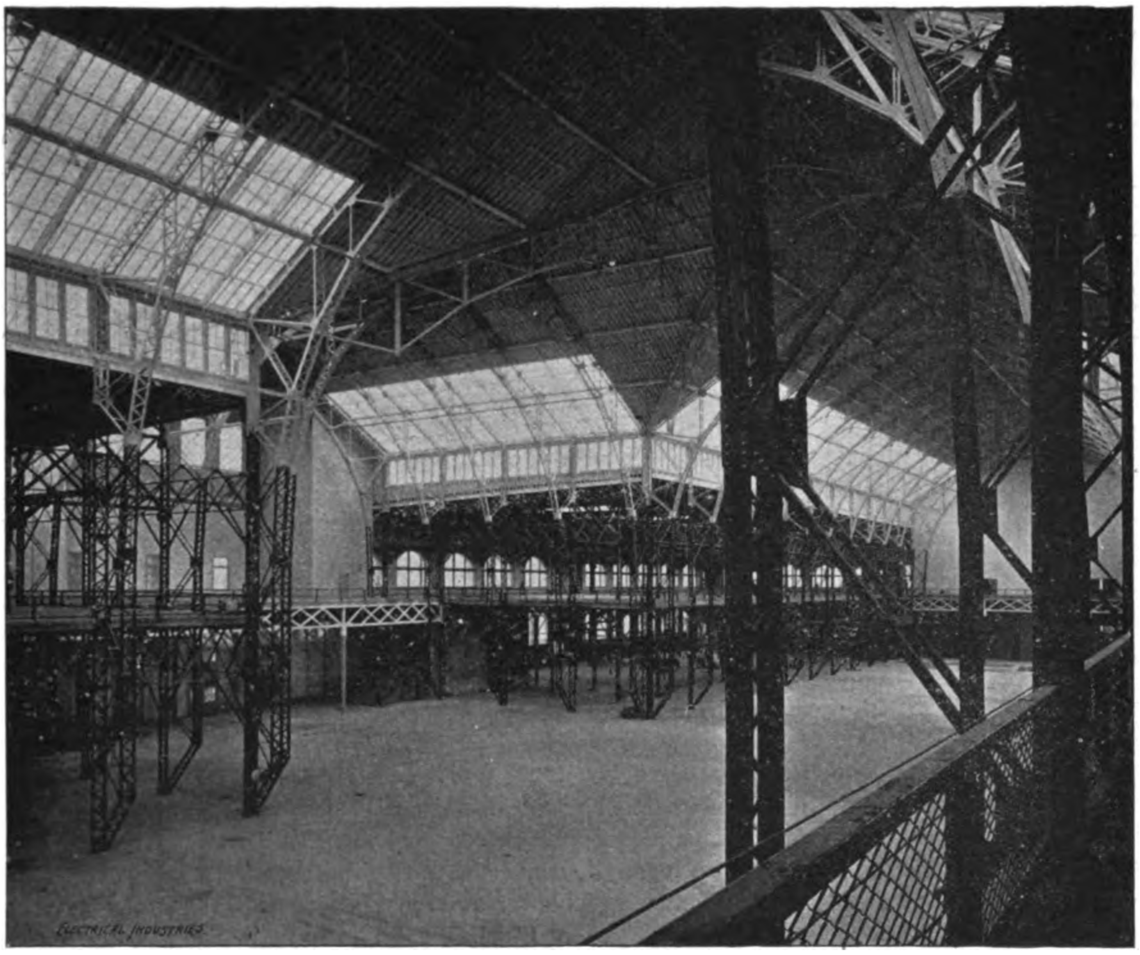


FIG. 4.—INTERIOR VIEW, ELECTRICITY BUILDING, WORLD'S COLUMBIAN EXPOSITION.

make, aggregating 1600 horse power and to evaporate 54,000 pounds of water per hour; located at VII.

The contract made by the exposition authorities with manufacturers of these boilers is based not upon their commercial horse power, but upon the amount of water evaporated, the price being $177.75 per 1,000 pounds evaporating capacity per hour. No boilers are as yet marked as installed in the annex, but from 5,000 to 6,000 more horse power will undoubtedly be contracted for which will occupy all of the available space. The boilers will all burn crude petroleum, the contract having been made with the Standard Oil Company for a supply during the entire session of the exposition. This oil is pumped from the pipe line to twelve large storage tanks at the southeast corner of the exposition grounds. These tanks contain an average of about 10,000 gallons each, and when the full power plant is in operation one tank will be emptied nearly every hour. The oil is pumped from the tanks into a stand pipe, whence it runs to the boilers, a distance of 3,200 feet. There will be no smoke or ashes, and the boiler room will consequently be an attractive feature of the exposition.

The boilers are carefully and neatly installed and make a very imposing appearance. They are on a level nine feet below the floor of the Machinery Hall. A gallery 20 feet wide extends the whole length of the boiler house, and is built for the special accommodation of visitors, so that full opportunity is offered to see the working of this part of the exposition. Part of this gallery, however, is given up to exhibition purposes, as in it will be installed feed water heaters that are used in connection with the plant as well as others that are exhibits only.

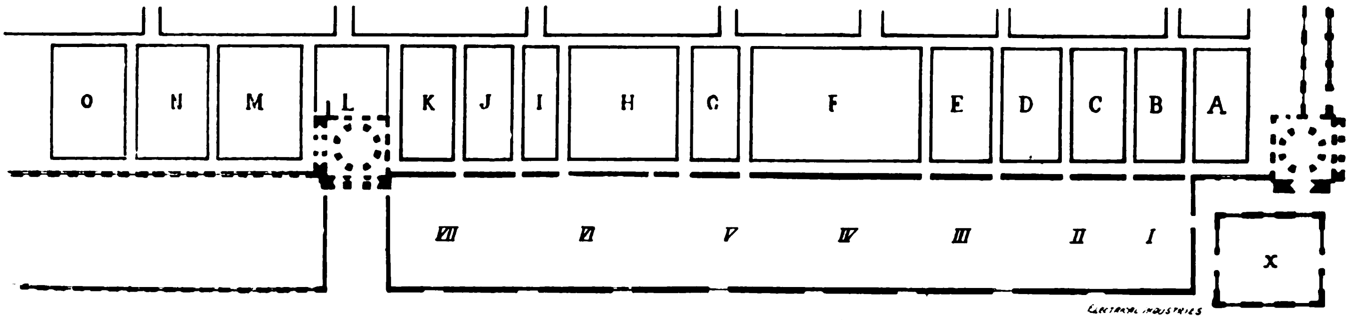


FIG. 5.—DIAGRAM OF ENGINE AND BOILER PLANTS, WORLD'S COLUMBIAN EXPOSITION.

Under this gallery is the main header for conveying steam to the engines. This header extends the whole length of the boiler house, is 36 inches in diameter, made of boiler iron, and is divided into seven sections so as to make allowance to take up all expansion or contraction. Each section is connected to its adjoining ones with equalizing loops. It is estimated that there will be a change of about 18 inches in the length of this header when steam is turned on and off. The boiler house is a plain but substantially built structure of corrugated iron and brick.

THE ENGINE PLANT.

This plant will be by far the largest and most varied exhibit of engines that has ever been made. So far as arranged for there will be one quadruple expansion, ten triple expansion, 30 compound and 13 simple engines. These engines will have an aggregate horse power of about 25,000, and this power will be utilized approximately in the following proportions: 13,000-horse power will be required to operate the incandescent lighting plant which is to light the grounds and buildings; 4,200-horse power will operate power generators which will run the motor circuits in the several buildings; 4,600 horse power will run the arc lighting plant which is to light the grounds and buildings; and the remaining horse power, which will be from 3,000 to 5,000 will run the line shafting in the Machinery Hall for the purpose of furnishing power to exhibitors.

Interest will naturally center upon the E. P. Allis & Co. 2,000-horse power quadruple expansion engine, which will be installed near the middle of the power plant in block F, Fig. 5. This engine will be belted to two of the 10,000-light Westinghouse incandescent dynamos. Two belts will be run on the fly wheel, one over the other, and each running a dynamo. In the same block with this installation is the double Fraser & Chalmers triple expansion engine of 1,000-horse power, which will be belted to a 10,000-light Westinghouse dynamo. The other installations in this block are two Westinghouse 400-horse power engines, each driving a 4,000-light Westinghouse dynamo; three smaller Westinghouse engines, each directly connected to an exciter and a McEwen tandem compound condensing engine belted to two "C. & C.' power generators. This block for convenience of locating on the diagram is marked F.

Beginning at the east end of the power installation and examining the diagram below the blocks are arranged in the following order, each containing installations as follows: Block A, circulating pumps.

Block B, Ball cross compound 480-horse power engine, belted to two Edison power generators 200-horse power each; an Armington & Sims simple engine of 400-horse power, belted to two similar generators, and a General Electric triple expansion engine 1,000-horse power direct-connected to two Edison multipolar generators 500-horse power each.

Block C, one Phoenix triple expansion engine of 500-horse power, belted to two Eddy power generators of 250-horse power each; a Phoenix tandem compound, also a simple engine, each of 250-horse power, and each belted to an Eddy power generator of 250-horse power and an Allis 500-horse power cross compound belted to a Westinghouse 500-horse power railway generator.

Block D, one Woodbury tandem compound of 600-horse power, and another similar engine of 375-horse power, each belted to two Mather power generators; one Ide simple engine of 200-horse power and an Ide tandem compound of 225-horse power, each belted to two "C. & C." power generators of 100-horse power each.

Block E, a Ball & Wood cross compound of 200-horse power, two simple of 150 each, and a tandem compound of 150-horse power, belted to Brush arc dynamos, of which there are sixteen in this block.

Block G, four Westinghouse compound engines each of 1,000-horse power capacity, and each connected direct to a Westinghouse incandescent dynamo of 10,000 lights.

Block H, a Buckeye triple expansion engine of 1,000-

horse power; an Atlas compound engine of 1,000-horse power, and a McIntosh & Seymour double tandem compound of 1,000-horse power; each engine belted to a 10,000-light Westinghouse incandescent dynamo.

Block I, two Westinghouse compound engines each of 1,000-horse power; each connected direct to a 10,000-light Westinghouse incandescent dynamo.

Block J, one Buckeye cross compound engine of 300-horse power capacity; two simple of 125-horse power each, a simple of 190-horse power and a tandem compound of 150-horse power, operating altogether 14 Fort Wayne arc dynamos each of 60 lights capacity.

Block K, one Russell double tandem compound of 506-horse power capacity and another of 216-horse power capacity, operating 20 Standard arc dynamos of 50 lights capacity each.

Block M, a Lane & Bodley cross compound, also a tandem compound, each of 300-horse power and a simple of 200-horse power, operating 16 Thomson-Houston arc dynamos each of 50 lights capacity.

Electrical Industries

ENGINEERING STAFF, WORLD'S COLUMBIAN EXPOSITION.

Crawford Hutchinson. L. S. Boggs. G. M. Mayer. J. Ward.
A. J. Davis. S. Bispham. O. G. Dodge. Locke Etheridge. J. A. Lounsbury. T. P. Gaylord.
Harry Jones. G. R. Green. J. Meaden. S. G. Neiler. G. B. Foster. L. S. Scovil. J. F. Gray.

Block N, a Bass cross compound of 224-horse power, operating six Excelsior dynamos of 50 lights capacity each, and an Atlas tandem compound of 500-horse power, operating 10 Thomson-Houston arc dynamos of 50 lights each.

Block O, a Watertown double tandem compound of 250-horse power, and two Skinner simple engines of 150-horse power each, operating 10 Western Electric arc dynamos of 50 lights each.

Each block of the engine exhibit is complete in itself and is divided by an aisle from adjoining blocks so that visitors may see the installation from all sides. All pipes, shafting, wires, etc., directly connected with the power plant are in the basement underneath so that there will be no complication of overhead apparatus. Of the twelve 10,000-light Westinghouse incandescent dynamos it will be noticed that six of them are belted and six direct connected. The space occupied by the entire engine plant is practically 1,000 feet long and 100 feet wide. The current on the incandescent circuits will be 2,000 volts, delivered at the converters, and just outside of each building will be a converter pit where the current will be reduced down to 100 volts, so that in no case will a high tension current enter a building. As the current leaves the dynamos it is taken direct into the sub-ways by main distributing circuits. The lamps used will all be designed for 98 volts. One switchboard will serve for the incandescent plant. This will be arranged in two stories with a gallery for access to the second story. This board will contain all the latest improvements in the line of switchboards and will be so arranged that any circuit can be thrown on to any machine. In the arc lighting plant there will be one switchboard for each block, and the same arrangement will be true of the power circuits.

In addition to the engines already mentioned and for which foundations have been made, several more engines will be installed, and contracts have been made for the following: Harrisburg Foundry & Machine Works, two Ideal engines; the Golden State & Miners Iron Works, one 250-horse power Corliss engine; B. W. Payne & Son, one 110-horse power engine; Cooper, Roberts & Company, one 100-horse power engine; Skinner Engine Company, two engines; one 500-horse power Hamilton-Corliss; Providence Steam Engine Company, one 225-horse power compound, and one 500-horse power Armington & Sims engine. The only engine of foreign manufacture for which contract has as yet been made is in England, for a 400-horse power Galloways. These engines will all be installed with the others and will be part of the great power plant.

The belting which will be used in this plant is a considerable item and the Exposition authorities have been fortunate in securing the hearty co-operation of belting manufacturers in supplying belts for use and which will also be entered for exhibition purposes. There will be five belts 72 inches wide, two of which will be supplied by the Page Belting Company and one each by the Jewell Belting Company, Charles A. Schieren & Company, and Fayerweather & Ladew. There will also be a 66-inch belt. A few belts are still to be arranged for, but among those already secured are the following: sixteen 10-inch belts, two 18-inch link belts, two 30-inch slotted belts, four 24-inch dynamo belts, two 24-inch double belts, two 15-inch perforated electric belts, two 15-inch link belts and two 30-inch link belts.

The sub-way through which the electric wires run to the several parts of the grounds begin directly under the floor of Machinery Hall; and adjoining the engine installation it is double, affording ample space for stringing all the wires, and yet have sufficient room for inspection and care of the wires. It runs from the Machinery building to the Electricity building, and from there branches out, wires being connected on the east to the Manufacturers' building, beyond to the Government building; and on the west to the Mining building, Transportation building, etc. Local circuits for the arc lighting and smaller transmissions are laid in pump logs.

The foundations for all the engines are now built, the flooring is practically all laid, and some engines have been placed on their foundations. Other engines as soon as they arrive can be placed in position at once, and it is probable that in less than a month part of the power plant will be ready to put in operation, as the temporary plant now in use was contracted for only up to the first of January.

MR. FREDERICK SARGENT, ELECTRICAL AND MECHANICAL ENGINEER, WORLD'S COLUMBIAN EXPOSITION.

Of the large electric cranes which have already been described in these columns for handling machinery in the Machinery Hall, one is now installed, and is proving itself quite invaluable in doing heavy work.

As has already been stated, the contract for providing the incandescent lighting plant for the buildings and grounds was awarded to the Westinghouse Electric & Manufacturing Company. This company in turn made arrangements with the New York Insulated Wire Company for its supply of wire, hence the incandescent circuits are all of them of this make of wire. The arc circuits consist of rubber covered wire, except in the conduits, where lead covered wire is used, both kinds having been especially contracted for by the exposition authorities with the Safety Insulated Wire & Cable Company. The amount of rubber covered wire used for this purpose is from 150 to 200 miles, while from 75 to 80 miles of lead covered have been used. The power circuits so far used have been only temporary ones. They are stretched on poles and will most of them, if not all of them, give way to permanent circuits. About 40 miles of wire will be required for this purpose, and will be contracted for at once. The subway extending lengthwise of the Machinery hall will be extended toward the western part of the grounds, and the arc and incandescent circuits which it had been proposed to string under the elevated road will be put in ducts instead.

When completed the power plant will consist of generating apparatus for 5,000 arc lamps, 100,000 incandescent lamps for the exposition purchasers, and 4,000 horse power for motor service. It is believed that exhibitors, state buildings, and other demands will make the incandescent lighting plant have a total capacity of at least 125,000 lamps, which are now provided for.

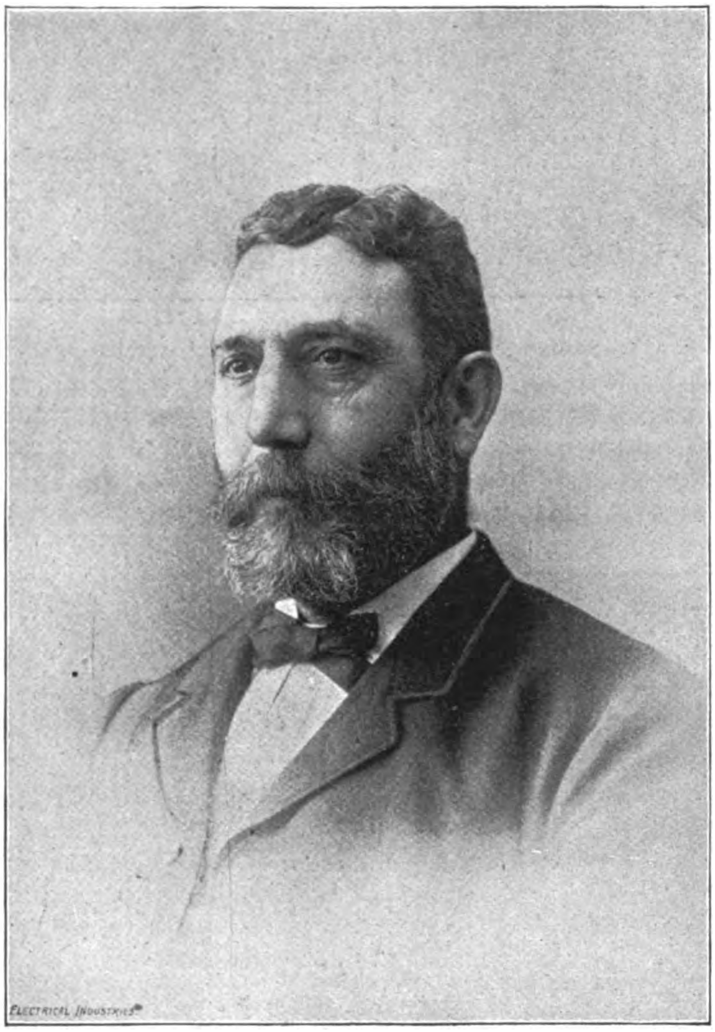
In the Mines and Mining building motors of 250-horse power each will operate two lines of shafting about 275 feet long. The motor will be installed on the ground floor, while the shafting will be suspended from the gallery above. The plans for this installation are now about completed. In the Agricultural building similar power will be installed in the annex, several lines of shafting will be run, and a considerable number of small motors of from 25 to 50 horse-power will be used in this building for purposes of transmitting power. These motors will perhaps aggregate 250-horse power or more. In the Electricity building exhibitors will install their own motors and furnish their own shafting as their exhibits may require. The current will be taken from the exposition mains, but the terms upon which this current will be supplied are not yet fully settled, but they will be at the smallest possible price. In Machinery Hall there will be from 5,000 to 6,000 feet of shafting which will be run by belting.

MR. R. H. PIERCE, ASSISTANT ELECTRICAL ENGINEER, WORLD'S COLUMBIAN EXPOSITION.

THE ENGINEERING DEPARTMENT.

The mechanical and electrical engineering work were combined several months ago, and Mr. Frederick Sargent appointed engineer in charge. Mr. Sargent selected as his assistant Mr. R. H. Pierce, and they with their assistants have had entire charge of the work of construction. The difficulties that they have contended against and overcome have been very great. Not only has it been necessary to carry out the work of construction on a scale, the magnitude of which has never been anywhere near equalled, but they have also had to watch the interests of the Fair very closely in the matter of awarding contracts and of securing as much of the apparatus as possible at the lowest figure obtainable, and yet secure the desired efficiency. In this department alone it is estimated that the Exposition has been saved over $2,000,000 by the manner in which the several installations have been arranged for, and the success with which all the work has been done is the highest compliment to the engineering and executive ability of Mr. Sargent.

The engineering staff of which Mr. Sargent is engineer in chief, Mr. Pierce first assistant electrical engineer, John Meaden first assistant mechanical engineer, and Luther Stieringer, consulting electrical engineer, comprises the following: S. G. Neiler, second assistant electrical engineer; J. A. Lounsbury, engineer in charge of incandescent lighting; G. B. Foster, engineer in charge of lighting; W. S. Monroe, chief draughtsman mechanical department; G. M. Mayer, chief draughtsman electrical department; T. P. Gaylord engineer in charge of electrical subways; J. F. Gray, secretary mechanical and electrical departments; O. G. Dodge, inspector electrical department; L. S. Boggs, engineer in charge of electric power; Locke Etheridge, engineer in charge of telephone and fire police signal; L. A. Scovil, superintendent of electric construction; S. Bispham, engineer in charge of foundations; Harry Jones. engineer in charge of erection of machinery; G. R. Green, inspecting engineer; Crawford Hutchinson, engineer in charge of boiler construction.



PROF. J. P. BARRETT. CHIEF. DEPARTMENT OF ELECTRICITY, WORLD'S COLUMBIAN EXPOSITION.

THE ELECTRIC FOUNTAINS.

When the Exposition proposed to construct electric fountains, foreign manufacturers thought that here was a case in which American electrical concerns could not compete. No electric fountains had been made in this country, and it was thought at first that the foreign offer to construct the fountains for $200,000 was the only one that would be made; but the General Electirc Company entered the contest and contracted to furnish both fountains complete, with generators, switchboards, colored water curtains—in short, everything that pertains to the fountains, for one-third of the foreign bid. The work of putting in the foundations for the two fountains has now been begun. It will be necessary to go several feet below datum to construct them, and caissons will be built for this purpose. Mr. Stieringer, the consulting electrical engineer to the electrical department, has devoted a good deal of attention to the perfect construction of these foundations, and has designed them both, not so much with regard to enormous size as to securing the finest and most effective results.

Obituary.

The death of Dr. Ernest Werner von Siemens, last month, removes from the electrical world one of the most eminent men that has had to do with it. His connection with electrical matters began in 1841, when he was only twenty-five years old, by his taking out a patent for electro-plating and gilding. It would be quite impossible to go over the list of his inventions because of his being assisted in his work by two brothers, the three working together for the same purpose, so that the results of their investigations are quite inseparable. Suffice it to say the progress of electricity owes a great deal to the geniuses of these men. Although seventy-six years old at the time of his death, Dr. Siemens was as energetic and interested in scientific matters as ever, and was following with particular interest the establishment of the Siemens & Halske enterprise of this country, and was looking forward with anticipation to the World's Fair, which he planned to attend in person.

Mr. M. M. M. Slattery, inventor of the well-known Slattery induction system, controlled by the Fort Wayne Electric Company, died last month. Mr. Slattery was only forty-two years old, yet had made an enviable reputation by his inventions in connection with the use of electricity.

Mr. George H. Meeker, who has made many friends in Chicago, was taken suddenly ill early last month, and died in a few days. The report of his death was sad news to the electrical fraternity, as he was genial, energetic and active, and popular for his personal qualities as well as his business ability.

At the meeting of the Chicago Electric Club, Monday evening, Dec. 19th, the following resolutions were passed:

WHEREAS, It has pleased the Almighty to remove from our midst two honored and beloved members of this club, and

WHEREAS, We acknowledge the wisdom of God while we cannot fathom His infinite designs.

Resolved, That we feel in the demise of George H. Meeker and M. M. M. Slattery, the club has lost two members of whom all were justly proud, as fellows and friends, genial and upright men, whose removal will leave a blank space in our circle, and whose presence will be missed at our social and literary meetings.

Resolved, That we deeply sympathize with the relatives of the deceased and earnestly commend them to the Father of all for the consolation He alone can give.

The Evansville Street Railway.

The electric street railway which has just been equipped and put into operation at Evansville, Ind., by the Evansville Street Railway Company deserves more than passing mention because of the completeness and thoroughness with which it is constructed. The officers of the company have taken advantage of successes and failures elsewhere and have studied leading stations and types of overhead construction so as to benefit by recent improvements. The result is, as would naturally be expected, an electric railway that is of credit to the company.

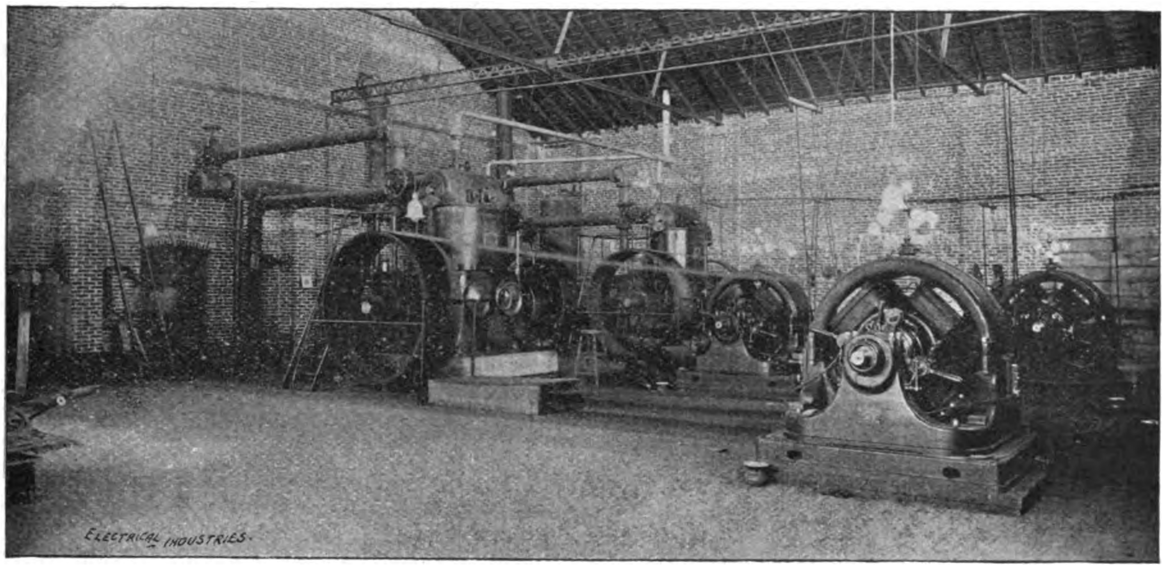


FIG. 1.—ENGINE AND DYNAMO ROOM, EVANSVILLE STREET RAILWAY.

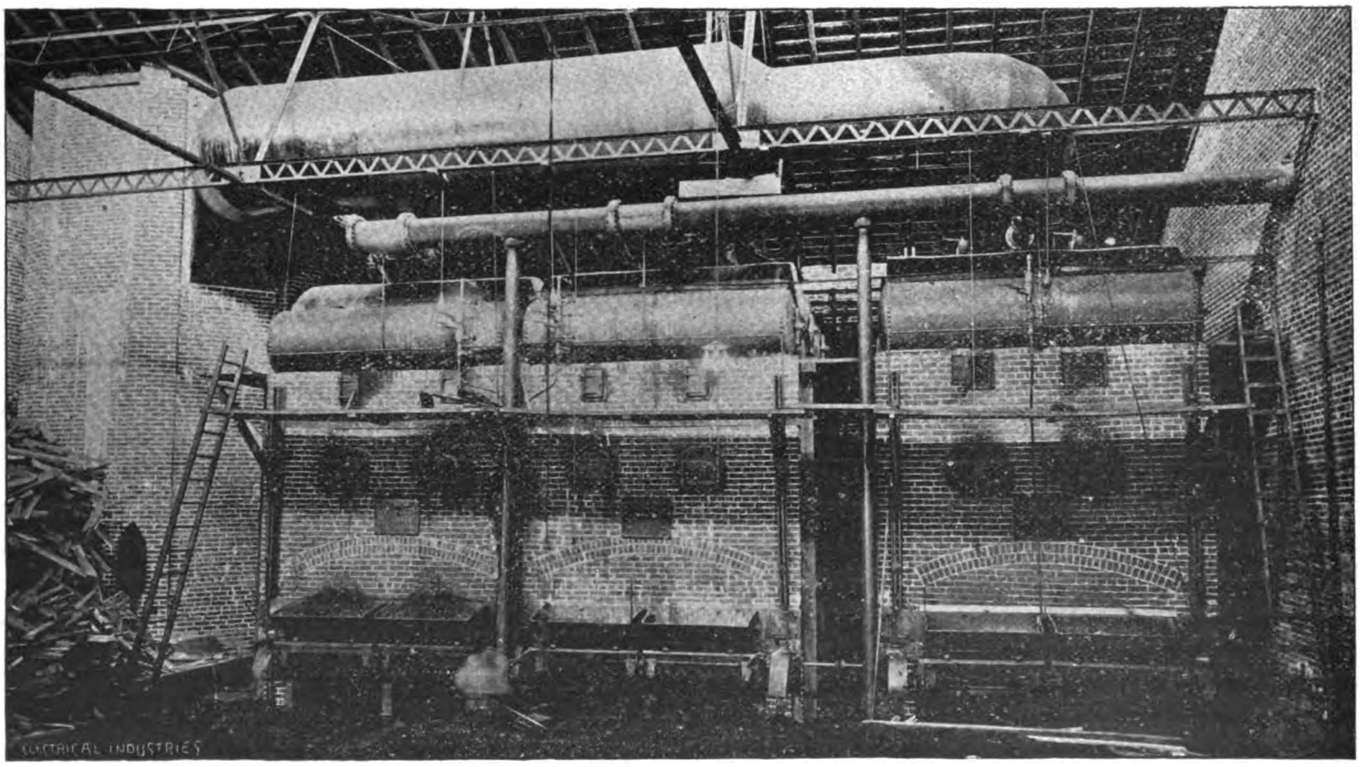


FIG. 2.—BOILER ROOM, EVANSVILLE STREET RAILWAY.

The power house is a brick building 75 by 150 feet in size while the car house is 50 by 150 feet. The roof is covered with slate and is constructed with iron trusses giving 18 feet in the clear. The boiler room is 75 by 50 feet. In this is installed a battery of three 250-horse power Stirling water tube boilers which are equipped with Brightman stokers. The accompanying illustration gives an excellent idea of the arrangement of these boilers. The steel smokestack is 132 feet high, is seven feet in diameter and was made by the Philadelphia Engineering Works, Philadelphia.

The engine and dynamo room is square, being 75 by 75 feet. This room, as will be seen by the illustration, is well arranged for economic working and for the easy operation of the plant. The engine equipment consists of three Westinghouse compound engines each of which runs at a speed of 250 revolutions per minute. They are belted to the three dynamos with 24-inch belts manufactured by Charles A Schieren & Company, New York. Special attention was given to the construction of the switchboard that it should be as complete as possible and furnish every facility for the operation of the plant. This board is 40 feet long and 12 feet high. It is made of quartered oak with slate panels for the switches. The arrangement is such as to give the manager of the plant instant and complete control of the circuits. The generators are of the

Westinghouse multipolar type of 250-horse power each. They are three in number and run at a speed of 525 revolutions per minute. Each dynamo has its triple pole switch, its ammeter, and its automatic circuit breaker on the switchboard. The feeder boards are on either side of the main switchboard, each feeder having a lightning arrester, automatic circuit breaker and switch.

In the overhead construction of the line iron poles are used within the city proper, and wooden poles in the outskirts of the city. Four miles of road have the central pole construction, while the balance of the line uses side poles. The trolley wire is of No. 0 hard drawn copper while the feeder wire is of No. 0 to No. 4, the wire being furnished by John A. Roebling's Sons Company. The line is divided into ten sections, each section having an independent feeder back to the power house, and in each feeder allowance is made for 10 per cent loss of current from the buss bar to the end of the circuit.

The total amount of track built by this company is 23 miles, and all but two miles has been relaid with 66-pound T rails of the Shanghai pattern. They are 6 inches high and are laid on oak ties which are placed two feet and a half from center to center. The rails are of the Illinois Steel Company's manufacture. No supplementary wire is used. All the rails are double bonded with the McTighe patent bond and are cross bonded every 300 feet with No. 0 cable from the rail to the city water pipe every half mile. The special track work of the line was manufactured by the Indianapolis Frog & Switch Company. The track construction was under the direction of Mr. J. W. Doherty, of New York, who laid 1,800 feet of finished track per day with 200 men, including the excavating of the old track which was relaid over the whole line. Barry & McTighe, of New York, were the consulting engineers and Mr. F. G. Daniell was the electrical engineer.

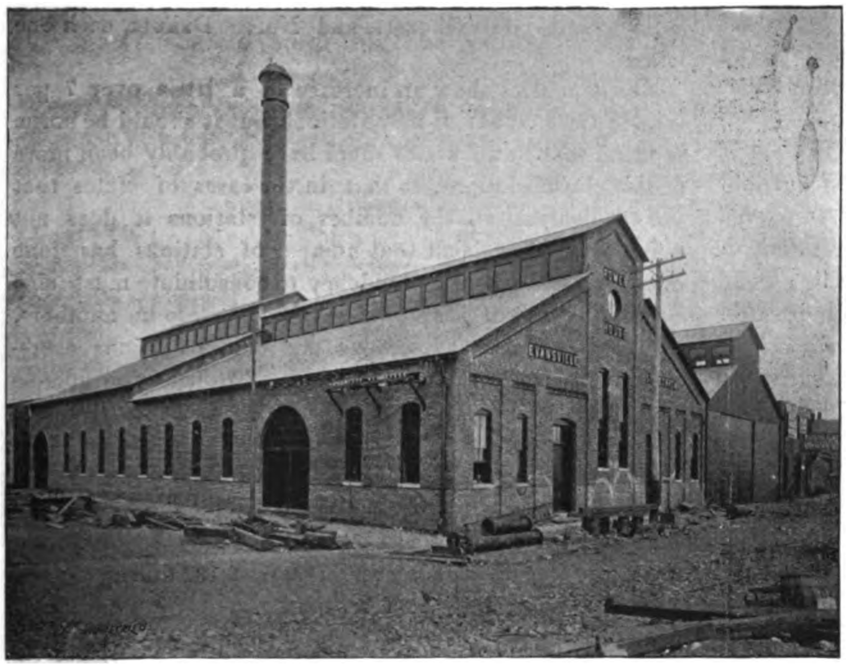


FIG. 3.—STATION BUILDING, EVANSVILLE STREET RAILWAY.

THE decision of the United States Court of Appeals in the case of the Edison Electric Light Company and the Edison General Electric Company against the Sawyer-Man Electric Company was handed down last month making the temporary injunction previously granted a permanent one.

Advances in Electric Heating.

BY W. R. MASON.

Some three years ago, while engaged in compiling matter for a new catalogue, my attention was attracted to an electric heater, which had been used with a certain amount of satisfaction on a few electric roads. It seemed to me at the time that there was a wide and promising field for electric heaters of various kinds, and accordingly I made arrangements with the company manufacturing them to take the general agency for their heater. The patentee of that heater deserves credit for what he accomplished, yet it is not surprising that faults were discovered in both their construction and form. My impression at that time was that while improvements would be made, and new heaters invented and patented, yet that even in an imperfect heater large sales could be made, as the advantages of this method of heating would more than counterbalance the objections raised. Advances in the science of electricity are so rapid that it is little wonder, that while a number of those who are foremost in the electrical business ridiculed my ideas, yet some half dozen of these very people are now engaged in exploiting electric heating.

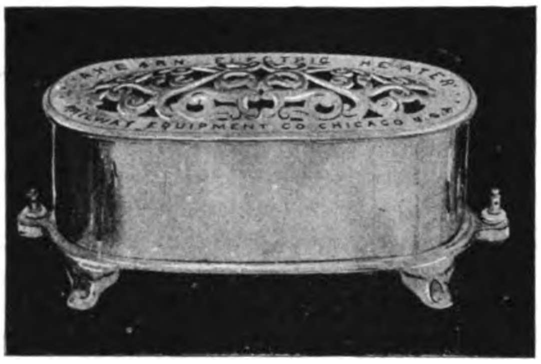


FIG. 1.—ELECTRIC STREET CAR HEATER.

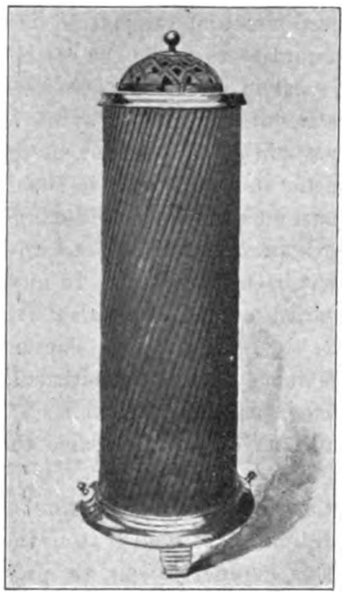


FIG. 2.—ELECTRIC HEATER.

The last three years' experience in this business has convinced me more than ever of the immense and successful future for electric heating, cooking, etc. Being anxious to furnish at all times the best obtainable, I have taken advantage of the latest improvements, and we are now offering one particular make of heater, but we are nevertheless pleased to see others interesting the public in this modern, convenient, and altogether desirable method of heating. The field is attractive and enlarging daily. The heater was originally designed to meet the demand for some means of heating, less objectionable than the coal stove, in street cars. The public is disposed to blame managers of street roads for not heating cars, yet no one is more anxious to please the riding public and make them comfortable than these managers. The objections to the use of the coal stove are so great that it is no wonder that it is a question whether its use is an advantage great enough to warrant its use.

In the first place, the stove takes, to say the least, the room of one passenger, sometimes two. The gas, the ashes and the smoke are ruinous to paint, decorations and cushions of the car, as well as disagreeable and unhealthful for the passengers. It requires constant attention, and is generally a source of danger to passengers, the car and the car barn. Burning of car barns and cars, caused by coal stoves in cars, is of frequent occurrence. A reliable electric heater does away entirely with every one of these dangers. Four of these heaters being placed under the seats, take no room whatever needed for seating passengers. On account of the distribution of the heaters, the car is heated perfectly and in all parts. It is not necessary to even look at the heaters during the day, and as long as the dynamo at the station is in operation, heat in sufficient quantity to warm the car is assured.

In former seasons objections have been made to electric heaters because of the frequency of the wires burning This has been entirely obviated in the latest improved heater, while the heat is stored in such a manner that, if desired, no current need be used during the evening rush, the car being kept warm for at least an hour or more after the current has been turned off. In most cases the cost of current consumed is not more than that for coal burned in a stove, while the other expenses connected with the use of coal stoves being done away with entirely, warrants the statement that heating by electricity is not only the most agreeable and convenient, but also the most economical method of heating electric cars.

The fact that something like 200 electric roads, in this country and Canada, are now heating their cars, wholly or in part, in this manner, seems to prove this assertion. Soon after introducing electric heaters for street cars, a demand arose for other heaters for use in private houses, stores, offices, etc., as well as for cooking purposes. An electric stove brought out by us this season has already had a large sale, and the advantages of having a warm room in a few minutes' time by simply touching a button, insures for this device a constantly increasing sale.

Hot water heaters for use in drug stores, bar-rooms, barber shops, as well as for making tea and coffee in restaurants and private houses, are also being furnished, while bakeries have been fitted with ovens, and baking by electricity is pronounced, not only a success, but as being a better method, giving better results than the old method. Electric heating for private houses is undoubtedly, in many cases, somewhat expensive, but on account of the great advantages we may certainly expect that another season will see a great number of houses using electricity, not only for lighting, but also for heating and cooking.

Progress of the Year in Electric Lighting and Railways.

In the issue of Electrical Industries for January, 1892 the directory of central lighting stations contained the names of 1,792 stations. During the intervening year the new stations that have been established have been added to the directory, so that the present issue reports 1,925 stations. Eleven stations have gone out of existence or for some reason or other have been discontinued since last January, so that the number of new stations established is 145.

An analysis of the changes of the year as shown by these statistics shows that Pennsylvania leads in the largest number of stations established, with nineteen; in Illinois and Missouri, there were eleven new stations established; in Texas, ten new stations; in New Jersey, New York, Michigan and Minnesota, nine; Indiana and Iowa each had six new stations; Ohio, Oregon and Georgia, each four; New Hampshire, Colorado and Nebraska, three each; Vermont, Virginia, California, Kentucky, Maine, Maryland, each two; while one new station is reported in South Dakota, Washington, West Virginia, Wisconsin, Alabama, Arizona, Connecticut, Louisiana, Montana and Florida. Twelve states show no increase, while Kansas shows the surprising decrease of six stations. In Rhode Island two stations less are reported and in Delaware, Massachusetts and North Dakota, each one less.

The statistics show an increase of a little over 7 per cent in the number of new stations, but it should be borne in mind that in all states there have probably been more or less consolidations, so that in the cases of states that show a decrease in the number of stations it does not necessarily follow that that number of stations has gone out of existence. The tendency to consolidate must also be taken into consideration in the increase in numbers, for there may, perhaps, have been more stations established than appear, but they have absorbed other companies or have been absorbed by them.

The directory of electric railways has increased in size much more rapidly during the past year than has the directory of central lighting stations, for a year ago this directory reported 384 electric railways. This month there are reported 516, showing an increase of 132 during the past year. During the past few months a large number of roads have gone into operation. South Carolina put into operation her first electric railway during the past year. In the number of new companies Pennsylvania again leads the list, showing a gain of twenty-one roads. Ohio gains thirteen roads, New York eleven, Iowa nine, Massachusetts seven, California six, Georgia, Michigan, Virginia and Wisconsin five each, and smaller gains are reported in nearly every state, the only states not showing any increase being Delaware, Kentucky, New Hampshire, South Dakota, Washington and West Virginia, while Arkansas loses one road.

Canada for some reason or other shows a loss of ten central stations having only 142 now against 152 a year ago. In the matter of railways, however, there has been an increase of from 9 to 16.

With the railway companies there has been the same tendency towards consolidation, probably a proportionately stronger one, than with the light stations, and this tendency must be considered in the matter of increases and decreases.

Arc Meters and Arc Lamp Revenues.

BY ALBERT SCHEIBLE.

Of the many and varied problems which confront the manager of an electric light plant, none are more apt to claim his attention than those relating to the net income of the station. In most cases he finds a large number of points touching on the running expenses and the outlay for repairs which leave a chance for good work in reducing these to their proper minimum. There certainly is no dearth of these expense items which vary from month to month and which deserve careful study in order that the plant may prove a profitable one. Much has been written on these points and perhaps the expenditure side of the station's accounts has been emphasized too strongly. At any rate, there are many station managers who are satisfied with watching this side of the income question, as if the gross revenue of the plant did not make as much difference. Yet the net income must always depend on the total returns for the current supplied, so that many a plant which prides itself on having reduced its expenditures to a reasonable minimum, may still have much to gain by watching the income and taking steps for its increase.

The two measures which will generally help to enlarge the returns are: First, the finding of new fields for the current so as to increase the output of the station. Then comes a problem, which in most cases has received but little attention, but which may have more in store for the plant than is generally supposed. I refer to a careful study of the methods of charging and collecting; for with a station fully supplying the demands for light, heat and power, while running on an economical basis, this is the only thing left to improve its efficiency. Perhaps it will be argued that the rate of charges and the demand for current are dependent on each other, but this only makes a study of these charges all the more important, and all the more likely to lead to changes that will benefit the station.

Within the past few years the electric motor has added to the usefulness of many a station, allowing the plants to be run a greater number of hours per day and thus giving a larger output from the same amount of machinery. This has been true of both arc and incandescent plants, and with the latter another era is dawning, now that electrical heating is being introduced wherever a supply of current is at hand. On arc circuits little can be expected in the heating line, as the risks from grounds are too great to be readily overcome in a way that would insure safety in the average kitchen. But the arc motor of today is already playing an important role in many plants. Some stations have also placed series incandescent lamps on their arc circuits, thus getting an added revenue from store and residence lighting in districts where it would not pay to run a separate incandescent circuit. These means of increasing the output of the station generally contribute a small though by no means unimportant item to the revenues, the mainstay being the arc lighting itself. Of the arc lamps, those used for city lighting are furnished at a yearly or monthly rate depending on the price of coal, the amount of competition and other local factors. The proportion of the city lights to those used for commercial purposes vary from place to place, and as the price paid by the city for the former is fixed at long intervals any gradual change would be looked for only among the commercial lights. These are commonly rented on a time contract system, and it is right here that the station manager may find room for some improvement.

The general scheme of time contracts for lamps is quite simple and may at first seem to be a perfectly equitable arrangement. The station agrees to furnish the lamps with current for a certain number of hours, depending on the consumer's business, the number varying from store to store.

Sometimes there are enough lamps in one locality to be burnt for the same hours so that it pays to run a separate circuit for these, while an overlapping line takes in another lot of lamps in the same district that are to burn an hour later. The result is seen in the nine o'clock, ten o'clock and midnight circuits so familiar to electric light people. Very often the lamps of one kind are too few or too widely scattered to make this plan feasible. Then the current is kept on tap for the latest contract time of any lamp and other users are expected to turn off their lights at the appointed hours. That is, all the lights on a circuit will be started at (say) six o'clock; then at nine o'clock certain customers are to turn out their lights, others at ten, and some at eleven, while the dynamos may not be stopped until midnight. This plan may seem quite fair in theory, but in practice it does not entirely satisfy either party. In contracting with a nine o'clock customer, the income is limited to that for three hours, while the amount of current supplied depends largely on the honesty and punctuality of the consumer. Those who have visited a station at about the hour when many of the users are to shut off their lights, will remember how the sparking at the commutator told of lamp after lamp as it was taken off the circuit long after the time had passed. A nine o'clock lamp may mean just nine o'clock to the stores close by the station, but how about the many scattered ones farther off? There it is often half-past nine, or even after ten before it pleases the user to spare the current.

The scheme which would naturally suggest itself as a cure for this, and which has been tried in a number of different forms is that of controlling the lamps either independently by time cut-outs, or in groups by switches operated on a separate circuit. In some places clock-switches have been used to turn the lights out promptly at a certain hour. The other and more popular plan is that of a special cut-out circuit for controlling the switches from the central station. That is, a wire is run to all places where the lights are to be put out at (say) nine o'clock and connects a series of magnetic release switches, all of which would be operated by sending a slight current over this wire. A similar circuit may connect the switches for the ten o'clock lights, or all may be placed on the same circuit but built with ratchet wheels requiring a different number of impulses to operate them. In any case this plan means one or more wires running parallel to the arc circuits and adding to the risk of grounds and crosses.

At first glance such a system of time cut-outs, whether operated by individual clocks or by a light current on special circuits would seem to solve the problem of maintaining a proper ratio between the lighting hours and the contract price. But does it do so in practice? Take the case of a so-called nine o'clock circuit, where the lights burn from six to nine in the evening. Here exactness in the lighting hours presupposes perfect regularity in everything else. It means that on many a dark day the consumer will have to wait half or three-quarters of an hour for his lights; and late in the evening the lamps may go out while he has his store full of customers, perhaps spoiling the bulk of his evening's trade. He has no control over his lamps, no way of adapting the lighting hours to the state of the weather and the special needs of his business. While he will admit that he gets all he pays for, the system is by no means an ideal one to him, as he cannot take the light as he wants it but merely as it is given to him. What nine out of ten consumers would prefer, is to have a steady supply of current on which they can draw as they need it, paying in proportion to the amount used. This means that they can start their lights at five or half-past four o'clock on cloudy days, and can burn them as late in the evening as their business may warrant it. Then if they burn more per month than they would have done on a three-hours-per-day contract they will be ready to pay extra, as the service will have been much more satisfactory to them.

And how will this affect the station and its revenue? The capacity of the plant remains the same, but the clock switches or the time cut-out circuits are discarded. A meter will be needed at every consumer's place to tell the exact amount of current used per month, the station basing its charges on the readings of this meter. The contract with the lamp user no longer calls for fixed lighting hours, but specifies a fixed number of burning hours to be paid for at the end of each month, and a certain rate for each additional lamp-hour. Many a consumer will be found to run up these extra hours, as the ready supply of current in the afternoon and evening presents quite a temptation whenever the light can be used to advantage. What is more, this plan settles the problem of arc lamps on the day motor circuits where it has always been a problem to get proper returns for the current furnished. The very least that the method of metering arc lamps can do, is to secure the income stipulated in the contract (which would be the usual revenue on the old plan) and the saving in unpaid-for current would offset the cost of the meters.

The station manager who has studied the needs of his customers, will know of many places where the actual amount would be considerably above this minimum, thus assuring him of so much extra income. In short the method of metering arc lamps gives the consumer free use of the current to suit his needs and promises an increased revenue to the station. This being the case, shrewd managers would do well to try this plan and see for themselves how much they can gain for their station, and how much more satisfactory a service they can offer to their consumers.

Overhead Construction of An English Electric Railway.

The South Staffordshire tramways comprise 24 miles of line which have been doing street railway service, yet have been operated by steam dummies. This power, however, has been not only rather too expensive, but also objectionable because the lines of this company pass over public highways and through towns. The directors of the company believed that electric traction would be much more suited to their purposes, and therefore secured consent of the local governing bodies to adopt it. The municipal authorities and the tramways company each sent an engineer to the United States to examine and report upon American systems of electrical equipment. They reported in favor of the overhead system, and the lines of the company have been equipped in this way.

In general, American methods have been adopted, but the engineer for the tramways company thought that he could improve upon American methods in overhead construction, and it will be interesting to see to what extent he has succeeded. Nine miles of track have been equipped electrically. This is single track with turn-outs. The cars used on this line have seats on top, consequently the arrangement of the trolley had to be somewhat modified, and the location of the trolley has been changed from the center of the roof to the side of the car. It consists practically of a mast secured to the side of the car, and which extends just out of reach from the upper seats. The trolley is attached to the top of this mast by a universal joint, and has a stiff spring to hold it in contact with the trolley wire. The pole construction consists of a single pole with bracket to which the trolley wire is attached, thus reducing to a minimum the amount of overhead wiring. On curves the trolley wire is stretched diagonally across instead of following the contour of the track. This construction makes two angles, but as the trolley wheel is held in close contact with the wire by the stiff spring, and at the same time works in a socket joint so that it always keeps parallel with the trolley wire, it is believed that the new construction will be satisfactory, and that the trolley will not be liable to jump the wire The trolley projects to one side of the car, the angle varying from 15 to 90 degrees, while it has a range of distance from the car varying from two feet and a half, its normal position on a straight track, to some over twelve feet in taking curves. The trolley wire is suspended 21 feet from the ground. Two motors of 15-horse power each are used, and these may be run in parallel or series as desired.

Street Car Mail Service.

In his last annual report Postmaster-General Wanamaker recommended utilizing street railway systems to make the delivery and collection of mails more efficient. St. Louis has not waited for the government to move in the matter, but through the courtesy of the St. Louis & Suburban Railway Company a car has been fitted up as a sort of street railway postal car, and is run wholly in the service of the post office. Its operation has proved very successful, and it is not improbable that several more cars of a similar nature will be put on the street railways of the city, running over the several lines, so as to make the delivering and collecting of mail more expeditious. The car in question makes stated trips, meets the postmen at stipulated places, and receives and delivers mails. The letters are stamped and sorted on the car, and an instance is reported where a letter was delivered within twenty-five minutes from the time it was dropped in the collection box.

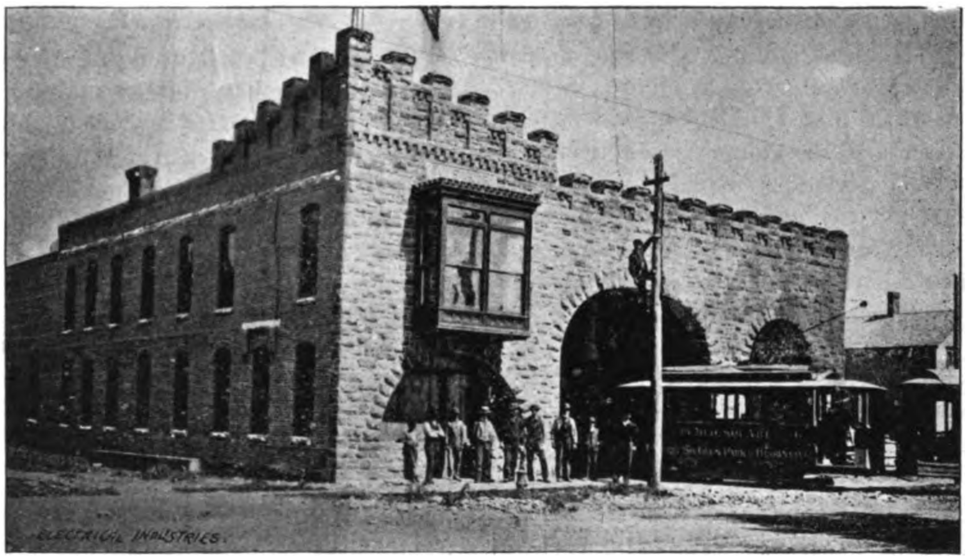
One objection that has frequently been raised by people against living in the suburbs has been poor facilities for receiving and sending mail. Many an electric railway can readily overcome this objection by furthering the interests of the post office in the manner that has been done in St. Louis.

The smallest electric light station in the world is probably one in the village of Bremen, Thuringia. It comprises a single arc lamp installed in a church. The dynamo is in a neighboring mill and is operated by water power.

Watertown Street Railway Co.'s Car House.

The Watertown Street Railway Company, Watertown, N. Y., has just completed a car house of which it feels justly proud. The building is shown in the accompanying illustration. As will be seen, the house has a stone front, the walls of which are two feet thick. The sides and rear are of 16-inch brick walls, and the stone foundation is four feet in depth. The timber roof is covered with tin, and the roof is supported by walls and two rows of timbers two feet square and fifteen feet apart, and by iron girders in the center space of the building where the transfer tables are used. The entire cost of the building finished was about $10,000. The building is 60 feet wide and 120 feet deep. It faces the south. The roof is 23 feet high on the west side, and 20 feet high on the east side.

Two tracks run into and through the building to transfer tables in the center, carrying cars to two tracks on the east side, running the entire length of the building, each track having a capacity of five cars. In the rear of the transfer tables on the main tracks, there are two pits thirty feet long and five feet deep, planked on the bottom and with stone walls on the sides and ends. In the northwest corner of the building is an enclosed pit-room sixty feet long with one track and a capacity of two cars. This room is used as a repair shop and is fitted with an electric motor run from the company's own power and driving small machinery. The shop is also provided with benches, tools, etc. The boiler used for heating the building is also in this room.



WATERTOWN STREET RAILWAY COMPANY'S CAR HOUSE.

The southwest portion of the building, 20x60, is divided into two stories ten feet between joists. The lower floor, which starts at the front, has a vestibule twenty feet wide and five feet deep; a, waiting room, twenty feet wide and fifteen feet deep; two toilet rooms twenty feet wide and six feet deep; conductors' room twenty feet wide by twenty four feet deep, and a lamp room twenty feet wide and six feet deep, all finished and sealed in hard wood, heated by steam and lighted by electricity. The second story contains the offices of the company. The main office, in the front of the building, is 20x30 feet; the private office, in the rear, is 20x24 feet. Toilet rooms and a wardrobe are between, and all are finished in oak and completely furnished with oak furniture. The total capacity of the car house is 22 cars. In the rear of house are two large wooden storehouses, 50x20 feet.

This road has two power stations, both operated by water power. There is one wheel of 200-horse power, and another of 120-horse power, each wheel driving an 80-kilowatt Edison dynamo. The 120-horse power wheel furnishes the city line two and a half miles in length, and the 200-horse-power wheel, a suburban line of three and one half miles in length. The end of the suburban line is about five miles from the station, requiring No. 0000 wire to carry the current. The dynamos are frequently changed to work either line, or will operate both roads when only eight cars are on the line. The city road is constructed of 52 lb. Johnson girder rails. The suburban road has 50 lb. T rails, all laid on a heavy bed and having cedar ties laid three feet from center to center. The speed of the dynamos is regulated by an automatic switch, which takes the place of hand switches. These have worked successfully for ten months.

The cars are of the Stephenson pattern, three being open dash, the same as the Broadway cars, and eight are of half vestibule ends of the same make. This road also uses ten open cars as trailers in the summer, and these are also of Stephenson make. The road is further equipped with rolling stock consisting of snow plow and two gondola cars. During the last fiscal year this company carried 800,000 passengers. It has an attractive summer park about three miles from the town called Glen Park. This park contains about 16 acres of woodland, on the bank of the Black river. There are also a six acre ball ground, a grand stand, etc. At Brownville, where the company has a small car house with a capacity of four cars, the line connets with steamer to Dexter, which runs through the narrows of the Black river. Dexter is situated on Black river bay, an inlet from Lake Ontario. The entire system of the road and all electrical appliances were furnished by the Edison company, seven motor cars being equipped with the Edison double reduction 15-horse power motors and four cars with two single reduction Edison 20-horse power motors. The generators are driven by belting. The cars have 30 or 33-inch wheels, and there are eight Stephenson and three Brill trucks.

THE aldermen of Chicago have voted to petition the state legislature for an amendment to the city charter so that the present municipal light stations may be permitted to generate electricity for commercial purposes. Professor Barrett reports that these stations have a capacity to do five times as much generating as they now do at very little extra expense.

Electrical Industries.

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H. L. ALDRICH. Secretary

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

Philadelphia is in suspense. The question as to whether the Traction Company shall be permitted to equip its lines electrically and use the overhead trolley is before the supreme court, and decision is promised early this month.

The electric lighting plant that is to be installed in the new Columbus Memorial building, Chicago, proposes to make use of a storage battery as auxiliary. So far as we are aware none of the new buildings of the city have attempted to make use of the storage of electricity, and we believe there is only one such installation among the large isolated plants in the city. Storage batteries are used quite extensively in Europe, and their economy and efficiency should be fairly tested in this country now that litigation over them seems to be at an end.

An important question in furnishing arc lights for commercial purposes is that of having the light ready for use the minute the customer wants it, and at his service as long as he wants it, and yet have him pay justly for what current he uses. There are several methods of solving this question, and all of them are considered in a paper published elsewhere in our columns this month. Both economic and electrical questions are concerned, so that managers of arc lighting stations will find a subject worth considering discussed here.

In order that our readers may have a comprehensive understanding of what the World's Columbian Exposition will do for electrical interests, we publish this month a general review of the situation. The great electric generating plant is in such shape now that full details regarding it can be published, and it will be seen that electricity will be reecived at the hands of the Exposition the recognition it deserves. The fact that four-fifths of the 25,000 horse power will be devoted to generating electricity will be a gratifying announcement to the electrical fraternity.

DIVIDEND ACCOUNT AND FUEL BILLS.

The popular tendency in manufacturing plants not to buy anew when the apparatus already in hand does not entirely fall down upon itself has been proved over and over again to be a mistaken effort in the line of economy.

An unusual instance which illustrates this is reported in the case of a large manufacturing concern in New England. This concern was not an electrical one, but it operated a power plant, and what is true of this particular line of manufacture would be equally true in generating electricity. The antiquated and ill-constructed power plant which this company has been operating burned fuel at a cost of about $96,000 a year. The company was reorganized and the power plant modernized and improved, and although its capacity was not made any less, its efficiency was so increased that the fuel bill has been reduced to $35,000 a year, a saving of $61,000, which in itself would materially change the dividend account.

It need not be necessarily inferred from this that every electric station which has an inefficient power plant can save $61,000 a year by making it efficient, but it does follow that it can save to a corresponding extent by correspondingly increasing the efficiency of its plant. In our recent issues we have devoted a large portion of our space to illustrating and describing the latest improvements in the line of efficient power house equipment, and we believe that there are many stations which if they will take the hint from the experience of this New England corporation, then compare the efficiency of their power plant with what it should be, as shown by our recent articles, quite a sum could be transferred from the expense account to the profit account.

ELECTRIC RAILWAY BUILDING.

The past year has seen a great number of the street railways using horse power equipped electrically so that as matters now stand it would look as though electric railway building during the coming twelve months would be to a large extent in the direction of building and equipping new roads; and judging from the present indications, many of the new roads, particularly in the more thickly settled portions of the country, will be either suburban or inter-urban roads, thus giving the actual competition with steam roads that has been threatened.

A feature in connection with the building of electric railways which is worthy of passing mention is that of the company furnishing the apparatus, also furnishing money with which to buy out established lines, consolidate them, and increase their earning capacity. The larger electrical companies seem to be doing considerable of this both with railway and light companies. The American Bell Telephone Company inaugurated a similar plan in the early days of establishing telephone exchanges. Afterwards it disposed of some of its holdings of such securities but they developed into such good investments that in many instances it purchased them back again at a decided advance in price. The holdings of many electrical manufacturing companies in light stations and street railways will in the same way very likely prove paying investments.

DEVELOPING WATER POWERS.

The attempt to utilize part of the great water power at Niagara Falls for industrial purposes, seems to be giving rise to similar enterprises in other parts of the country. Already some well-known electric light and railway stations are depending mostly if not wholly on water for their supply of power, and in the mountains of the far west, where fuel is very costly, a number of plants have been installed to utilize electricity for mining purposes. Such installations as these are insignificant in importance when compared to the great undertaking at Niagara Falls, but like that they demonstrate the possibilities that lie in water powers for purposes of generating electricity. They show that the manufacturers of devices for developing this power have demonstrated their ability to make them a success, also that they have accomplished the next most important step and convinced the investing public of their success.

Water power under ordinary conditions is the cheapest known power for generating electricity, and it is a circumstance that has attracted attention in Europe, that capitalists have purchased most of the available undeveloped water powers with a view to ultimately using them for purposes of cheaply generating electricity. In the United States there is a tendency to make similar long-sighted purchases. But these purchases as a rule are on a large scale, as they have in view the development of horse power up in the thousands, and they are to be used as the basis for building up large industrial towns. In New England several Holyokes and Lowells are in embryo adjoining large undeveloped water privileges. These enterprises have reason on the face of them as they propose to use electric power only to the extent to which it is now practically developed, and they are attracting the attention of eminent engineers who are capable of carrying them to successful consummation. And in this respect these enterprises are invaluable factors to the progressive development of applied electricity. A few of them in successful operation will put a premium on every water privilege in the country that is capable of development into supplying power.

In this connection the World's Columbian Exposition will be of assistance to the furthering of such projects, as it will demonstrate on a large scale the evident success of the transmission of power by the use of electricity and electric motors. The Exposition will make the principle popular, and a few successful instances of the installations in question will do the rest.

DECENTRALIZING EFFECT OF FIVE CENT FARES.

The system of five cent fares now in use on all street railways in the United States is causing a deal of quiet thinking in Europe, where this system is little used. In England, for instance, this system is almost unknown, fares being in proportion to the distance traveled. With people who are obliged to make every cent go as far as possible these differences in fares count for considerable, consequently in a large city like London the intramural systems tend to concentrate population as near the heart of the city as possible, because of the cost of suburban fares, while the one fare system has a tendency to decentralize population. In Chicago one fare will carry a passenger a block or an average of about eight miles in any direction from the heart of the city.

European and especially English thinkers are beginning to realize that here is an American idea that is well worth adopting. A somewhat modified system to this, called the Zone system has already come into use on steam roads in some parts of Europe. But its application is more necessary to intramural traffic in order to relieve as much as possible the congested condition of the larger cities, and this system would not accomplish as much towards decentralizing population as would the straight one-fare-a-trip system. Very few modern improvements have so benefited the cities of the United States as has the electric railway because of the facilities for rapid transit it has afforded. It has improved the health of people by permitting them to live well out from the heart of the city, and it has made many a man more self reliant and a better citizen by permitting him to go well towards the outskirts of the city and build himself a home which his limited means could not have afforded but for rapid transit facilities and the low fare—for the electric railway could not have been the economic and commercial success it is had the one fare system not prevailed.

BUSINESS CONDITIONS, RETROSPECTIVE AND PROSPECTIVE

Just a year ago we published in these columns a series of interviews on the business indications for the year 1892 and the concensus of opinion was that so far as electric lighting was concerned the extensions would be largely in the direction of isolated and private installations, while in electric railways the large cities would show less hostility to the overhead trolley, and the work of construction and reconstruction would be carried on in these large cities, while at the same time roads would be very generally electrically equipped in smaller places. How have these predictions been verified ? Statistics which we publish elsewhere show that our directory of central stations has increased some over seven per cent in numbers during the past twelve months, while the directory of electric railways shows a twenty-five per cent increase. In the matter of isolated plants no definite figures are at hand, but manufacturers and dealers all report a good volume of business.

For the coming year indications seem to be not unlike those of a year ago. Central station lighting is somewhat limited so far as establishing new stations is concerned, because there are very few large towns that do not have their electric light stations. But the extensions which were considerable last year, promise to be equally as great if not greater this year. And methods looking toward greater economy of operation will be closely followed out. Isolated plants will be built in greater proportion than ever before, for large buildings utilized for almost any purpose now are regarded as behind the times if not lighted by electricity. From an investor's standpoint, it pays to offer tenants electric light, while insurance companies acknowledge that a building if it is properly wired is a good risk so far as danger from fire is concerned. As regards electric railways the conditions appear to be about the same this year as they were last year. New York, Chicago, Philadelphia and other large cities are still fields of much promise, while many horse roads are yet to be equipped electrically. Interurban and suburban lines will be built and extended, and the number of existing roads that do not make extensions will be few.

In some new directions, too, there are encouraging prospects. Electricity for heating purposes is gaining in popularity. Motors of small units—fraction of a horse-power—are being made, while artistic effects in lighting are in greater demand than ever. So far as the World's Columbian Exposition is concerned, its influence will be felt more a year or two hence than this year, as it will educate people up to an appreciation of the varied uses for which electricity is peculiarly adapted, but which have not yet been fully assimilated because of their newness, and radical changes from old methods.

At the meeting of the National Electric Light Association at St. Louis, February 28th and March 1st and 2d, there will be no exhibit under the auspices of the association, whatever exhibits there are being made by the manufacturers and dealers as seems to them most desirable.

An Ideal Central Power Station.*

BY C. J. FIELD, E. J. COOK AND F. BOURNE.

It was with some reluctance that we accepted the title of this paper, realizing all that the words imply and the difficulty of fulfilling their requirements. We therefore have tried to carry out the idea as fully as possible by taking as a design a type of station which seems to indicate more fully than anything else the latest and prospective development of the best practice in central power stations.

We will, therefore, take the subject up and divide it into several different heads or divisions, and try in general to indicate, by the plans and specifications illustrated herewith, what we believe to be an ideal central power station, and will treat it by giving a brief general outline of the several points, and close it by attaching to the paper what may be termed a sort of general specification covering the important points—as building, engines, boilers, generators and piping.

UNIT OF POWER.

The unit of power to be selected for the central power station is one of the first and mo t important elements to be considered after deciding on the capacity of the station. We have selected for this ideal station 6,000 horse-power as the total capacity. The question immediately arises, how many units of power shall it be divided into? We have found the following as a good rule to follow in deciding on the size of units, and that is, the number of units in any power station shall be the fewest consistent with safe and economical operation of that station. This shall be our foundation stone to build upon, and should be followed in the broadest possible sense. Experience has too often proved that power stations have been divided into too many units. This has been occasioned largely by two reasons: First, uncertainty of the development of the capacity of the station; and, secondly, inability or inexperience of manufacturers in the development and building of large generators.

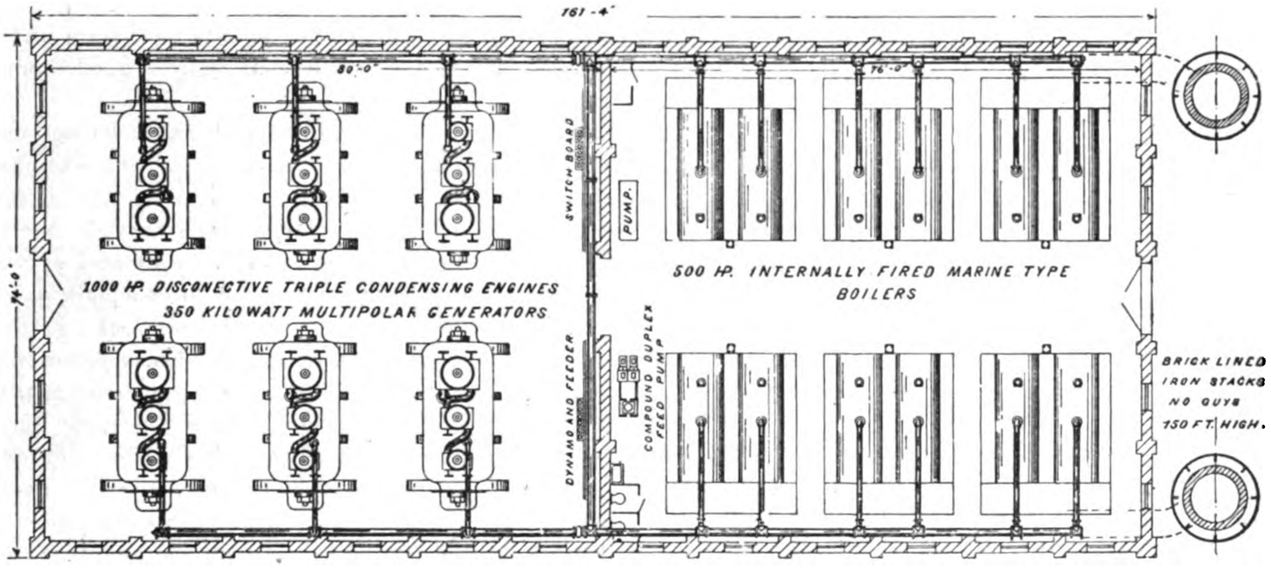
161 - 4"
80'-0"
76'-0"
74'-0"
SWITCH BOARD
PUMP.
1000 HP. DISCONECTIVE TRIPLE CONDENSING ENGINES
350 KILOWATT MULTIPOLAR GENERATORS
500 HP. INTERNALLY FIRED MARINE TYPE BOILERS
DYNAMO AND FEEDER
COMPOUND DUPLEX FEED PUMP
BRICK LINED IRON STACKS NO GUYS 150 FT. HIGH.

FIG. 1.—AN IDEAL CENTRAL POWER STATION.

The business now of building power stations and manufacturing the apparatus has reached such a commercial stage of development that both of these factors are eliminated. We now find capital ready and willing to invest in large power station enterprises, both for railway and general power work; also manufacturers with experience in machinery and ability to develop and build any commercial size of generator required or called for.

The unit of power should be proportionate to the size of the station, and in the size of station we selected we believe a thousand horse power unit to be one which fulfills our requirements in every respect, both for safety and economy in operation. The engines are so built that where a small amount of power may be required for light loads late at night, the engines can be operated with economy on reduced capacity, even down to a few hundred horse-power. This removes the necessity for one or two small units as has been customary to install in some stations of this class of work. They, as a rule, fill the space which could be taken by a larger size generator. A larger number of units proportionately than here laid out means additional expense in handling and caring for the machinery, also additional building space and real estate. The problem is now to concentrate all power into as few units as practicable.

DIRECT CONNECTION OR BELTING.

The problem is still in the minds of many people whether to use generators directly coupled to engines, or belted as in the earlier type of station. Formerly we had no choice in the matter. Generators, except in a few cases, were not built in this country for direct connection work in a commercial sense. We could only belt to the engine directly or through counter shaft. We do not propose to go into any extended controversy or argument on the three styles of connections, but only point out a few facts to be considered in this connection.

In a power station of the size herein indicated and located, as would generally be the case in or about a large city, entailing considerable expense for real estate, and more expense for the building, the problem which at first reaches the engineer's mind is how to concentrate this power within as small a space as is practicable without crowding, and also to economically operate the plant.

Looking at it from this point of view, the relative space required is, roughly, as two to one; in other words, a belted plant would require about five square feet of floor surface per horse-power as against two and one-half square feet with direct connection plant. This means a saving of one-half the cost of real estate in building and also concentration of the power for handling. On the other hand we have not secured flexibility of connection between the engine and generator, which we have in the belted plant, and the relief to the engine which is afforded by belt against the shocks of short circuits, etc. These are facts which should be more fully considered than they have been in the designing and building of a proper type of engine for direct connection. Ample fly-wheel capacity is one of the most important requisites for such an engine and ability to withstand direct shocks of short circuits and overloading of the generators. When these problems have been fully met, both theoretically and practically, we have no doubt that the development of the direct connection station will be rapidly extended. At present we are just beginning to enter what might be termed the era of direct connection work commercially, having as a basis for experience small practice in this country in special cases and a more extensive practice in Europe in this line.

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* Read before the Chicago Electric Club, December 19, 1892

POWER STATION BUILDING.

For power station building there are shown in Figs. 1, 2 and 3, general features and details of construction of a building adapted for this style and capacity of station.

The power station building is a factory for producing a commercial commodity and should be treated in that sense, the essential requirements being solidity of construction and protection against fire or any other accident to the machinery contained therein. The design of these buildings is too often placed in the hands of local architects, inexperienced and unacquainted with the requirements of such a building, and we find as a result many power stations in which the machinery has to be placed to fit the building, instead of, as it should be, the machinery laid out and the power station built to cover and properly protect it; being built, therefore, from an engineering point of view instead of an architectural one.

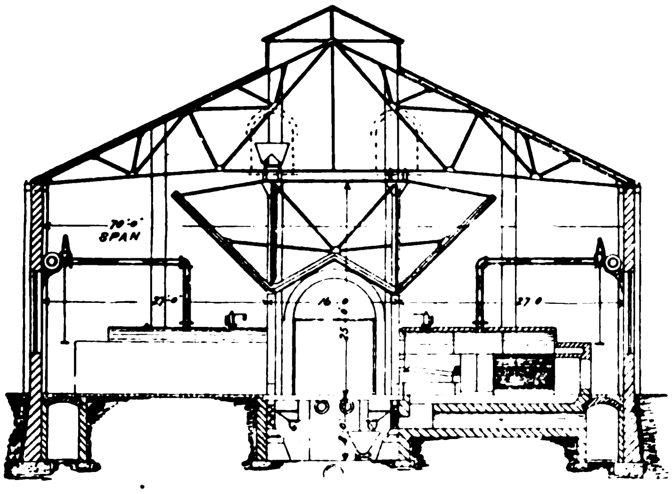


FIG. 2.—AN IDEAL CENTRAL POWER STATION.

Without attempting to go into details or producing a regular building-specification, we have tried, under the head of "Suggestions for Building Specifications," to cover the main features required in such a building.

BUILDING SPECIFICATIONS.

Excavations—Excavate the entire space under the engine room to a depth of ten feet, so as to get clear head room of eight feet in basement. Excavate for all side, cross and gable walls, all foundations, and also central space between boilers to form a basement under the boiler room for ash and coal handling apparatus, flue and pipes.

Foundations—If ground is good, lay base of concrete (four broken stone, two sharp sand, one hydraulic cement) and make footing courses of brick work or coursed rubble masonry of good, firm building stone, laid in cement mortar of three parts sand to one part cement. In case piling is necessary, test piles should be driven on different parts of the property in order to determine the bearing capacity of the pile under the conditions present, noting the amount the pile sinks under the last blows of the "monkey." Allow a factor of safety of from 4 to 15, depending on the conditions present. Piles should be of hemlock or spruce, perfectly straight and round; a 40 foot pile having not less than a 12 inch butt—the piles, after being driven, to have heads sawed off below mean low water to a uniform level; all piles in water to be capped with granite foundation stone, while those with heads in earth to be capped with a grillage of 12x12 spruce and 3 inch plank timber, and the whole filled with concrete well rammed. Lay foundation proper on this grillage.

Walls—All walls should be of brick work from 16 to 20 inches thick, with pilaster at each roof truss, having at least 8 inches projection and 24 inches face. Carry these to a height of at least 25 feet, so as to allow clear head room of at least 20 feet below the traveling crane in power house. All brick should be burned and should have clean, sharp edges, no salmon or light colored bricks being allowed. All brickwork should be laid in cement mortar. The cement should be Dyckeroff's or English Portland. All bricks in the face of the wall should be selected. All joints should be pointed. Pilasters on side walls of engine room should be built out by offsets and capped with stone binder for carrying rails of traveling crane. Set side ventilators in walls near ground line.

Roof—The roof should be iron truss, riveted type, furnished with iron louvre, with side ventilator that can be operated from the floor. The top of louvre should be furnished with heavy hammered glass. The roof should be covered with Norway pine plank, splined and then covered with black slate of good quality laid with not more than 5 inches to the weather. All flashing around walls and all gutters to be of 16' ounce copper. The whole to make a weatherproof job.

Engine Floor—The engine floor should be of two layers of plank, the first of yellow or Norway pine splined with hard wood, this floor to be covered with about one-eighth inch of plaster and with a second floor of seven-eighths inch second quality maple laid at right angles to the first. The first plank to be not less than eight or more than 12 inches and securely bolted by hook bolts at every beam to the iron I beams. The second floor should not be over 4 inches in width and should be blind nailed. All plank should be neatly fitted about all foundations and hand planed and smoothed and finished with two coats of boiled oil put on warm.

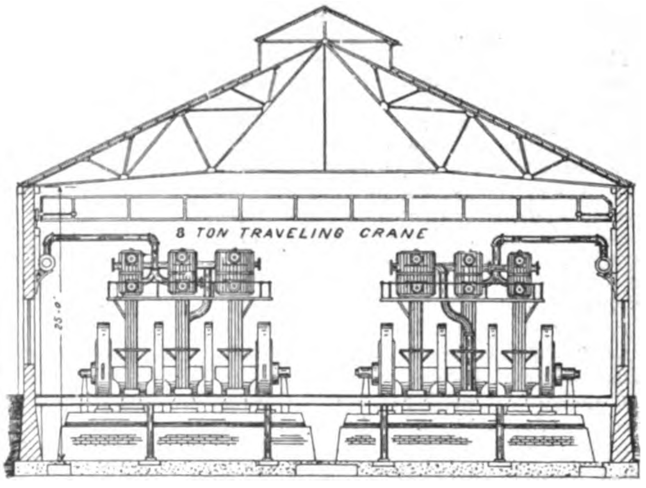


FIG 3.—AN IDEAL CENTRAL POWER STATION.

Engine and Boiler Room, Basement Floor—This floor should be made of not more than 6 inches concrete, well rammed and graded to drain, and finished by means of fine stuff floated smooth by means of hand trowel.

The boiler room floor between boilers should be made of steel I beams covered by means of cast iron plates of suitable pattern. All other parts of the fire room should be finished by means of concrete cement same as basement.

Doors and Windows—All floors or main doors should be of some wood ceiling, and made, say 2½ inches thick and finished with large wrought iron hinges (oxidized hinges and knobs), All doors in cross or partition walls should be made of beaded white pine ceiling laid diagonally and securely nailed, covered with a layer of asbestos board and then entirely covered with black sheet iron fastened by means of round-headed nails. These doors should be sliding with friction rollers, track, etc. All windows should have box frames and all sashes have four lights of American glass, best quality, well bradded and back puttied, fitted with noiseless pulleys, cast iron weights, brass chains and sash locks.

Painting—All woodwork should have not less than three coats of first-class lead paint ground in oil; this includes under side of roof, windows, doors, etc. All iron should receive two coats of metallic paint, one before erection and one after the structure is completed.

ENGINES.

Engine manufacturers and designers today are devoting their best time and attention to the development of a type of engine best adapted for electrical power work. We find, therefore, more progress being made this year and still more promise for the year to come than has been made in a number of years on this work. The old high speed engine has done well and the Corliss engine too. Present work and requirements seem to tend to a type of engine combining, it might be said, the good features of both, filling a middle ground and adapting itself more fully to the demands and requirements of large central station work with direct connection. Engines meeting these requirements are now being built and manufactured by such firms as the Lake Erie Engineering Works, Dickson Manufacturing Company, Cramp & Sons' Ship & Engine Building Company, Pennsylvania Iron Works Company, McIntosh & Seymour, E. P. Allis and other builders. We have tried to indicate the requirements of such an engine in the following specifications:

ENGINE SPECIFICATIONS.

Duty—Electric railway and power work. All parts extra heavy.

Type—Vertical, three crank, triple condensing.

Power—Ability to develop for short periods of time a power of at least fifty per cent above its rated capacity without dropping off in speed of revolution.

Regulation—Regulation effected by means of a shaft governor acting on the valves of high pressure cylinder alone. Governor designed to cut off all lead of steam valves when practically all load is thrown off the engine. The momentary variation of speed of revolution (i. e., the variation that would take place in three to five seconds) not to exceed 2½ per cent, when one-half the rated load of the engine is thrown suddenly on or off; indicated by means of a tachometer belted direct to the engine shaft.

Economy—Economy, with condenser under average economical load, to be not more than fourteen (14) pounds of steam per indicated horse-power per hour with 150 pounds initial steam pressure and 26-inch vacuum. This assumes that the steam is not to exceed 2½ per cent of moisture and the first cylinder steam jacketed with full boiler pressure.

Valves—To have four valves to each cylinder. The steam and exhaust valves to be independent, with exhaust valves moved by separate gear. Valves on high pressure cylinder to be either of the piston type or flat valve, balanced with pressure plate. Valves on intermediate pressure and low pressure cylinders to be of flat type, either four ported, partially balanced grid-iron or Corliss type.

Clearances—Clearances not to exceed eight per cent in the high pressure cylinder and three per cent in the intermediate and low pressure cylinders. Cylinders to be protected by non-conducting covering, such as magnesia or asbestos and steel or cast iron jackets for finish. Cylinders in receivers to be protected by means of relief valves.

Frames—To be cast iron girder-type "*A*" frame.

Shaft—Of best forged steel with built-up cranks and counter-balanced in one piece.

Bearings—All main bearing surfaces such as shaft bearings, slides, etc., should be water jacketed.

Gallery—Engine to be furnished with one or more galleries from which it can be operated as well as from the floor, and offering easy and safe means of access for lubrication and inspection.

Lubrication—Engine to be provided with either oil or grease lubricating apparatus, such that it can be lubricated as thoroughly when in motion as when at rest. Each cylinder to be provided with sight feed lubricators as well as oil pumps, and the entire engine, if oil is used for lubrication, to be fitted with sight feed lubricators. In the case of grease lubrication provision is to be made to allow any part to be lubricated individually, as any system of grease distribution from a common center involves the possibility of stoppage of tubes with dirt or foreign substances.

Fly or Belt Wheels—The engine should be provided with intermediate wheels between the cylinders where possible, so as to bring the shaft as near the condition of uniform load as possible. Allow 48 pounds per indicated horse-power in case of electric lighting and 70 pounds in electric railway and power work for weight of fly wheels. Rim of wheels on a basis of 5,000 feet velocity of the rim per minute. Piston speed 650 feet per minute.

Rotative Speed—A mean figure between a high, or what is commonly understood by high, and low speed; say 120 revolutions per minute on a 750-horse power triple.

Remarks—The power the engine should develop when connected direct to an electric generator should be determined by the capacity of the generator first, and also its capacity for overload. The engine should have an ultimate capacity approximating that of the generator.

Experience has proved that an engine of large power can be regulated closely as regards speed of regulation, by means of a shaft governor acting directly on a properly designed valve and gear on the high pressure cylinder alone of a triple expansion engine. The governor should have a "gravity balance" in case the steam valve on the high pressure cylinder is placed in such a position that it is free to move vertically, as is generally the case in this type of engine. The governor should also have a centrifugal or "running balance" when the engine is in motion. As mentioned in specifications, the governor should be designed to cut off all lead of the steam valves operated by the governor, so that when practically all load is thrown off the engine the governor will admit absolutely no steam to the high pressure cylinder, thus compelling the engine to decrease in speed by having only the remaining speed in the first and second cylinders to draw on, instead of the amount that would be admitted by the lead of the high pressure cylinder valves, as usually done today.

The specifications for valves in the engine described follows logically when the regulation of the engine is obtained by means of a shaft governor, acting directly on the high pressure steam valves without the intervention of any intermediate gearing to assist the centrifugal force of the governor, thus depriving it of its sensitiveness in changes of speed. The piston type of valve is open to the objection of leakage, but inasmuch as any leakage would be expanded in the next two cylinders of a triple, the simplicity of the valve and its action under high pressure steam tends to balance this argument. It is essential to have the valve balanced on account of the high steam pressures used in this cylinder. The valves on the intermediate and low pressure cylinders as already specified, would give a practically perfect steam distribution when moved by the eccentrics and the engine can then be adjusted to the service required, be it condensing or non-condensing.

One of the most vital points of an engine for electric service is that of main bearings. They should have a surface velocity of not exceeding 350 feet per minute, with a main bearing pressure per square inch of projected area of journal of not more than eighty pounds. This is considerably within the safe limit of cool performance and easy operation. If the bearings are designed in this way, it would admit the use of grease on all the main wearing surface, which in a large type of engine for this class of work we think advisable.

In regard to the location of fly or belt wheel, we said in the specification that the engine should be only with intermediate wheels between the cylinders, so as to bring the shaft within the condition of practically uniformly loaded beam. This will prevent excessive wear on any one main bearing of the shaft, and in that way allow it to become other than a straight line.

In regard to rotative speed it is a mutual condition between the engine and generator, and is too often determined by financial considerations. The faster speeds permit less cylinder condensation in the engine, but require a greater amount of care in the engine room. The tendency to change among large engines of the type for which we are furnishing specifications is toward the medium rotative speed.

BOILERS.

After the engines, one of the next most important factors of a power station is a good type of boiler. There may be said to be boilers and boilers, many types of them, but if we look carefully over the field we can in general bring them down, as far as concerns a power station of this kind, to three types or classes: First, the plain horizontal return tubular boiler, which has probably been more largely used in power station and mercantile work than all the other boilers combined, and where there is ample space and a working pressure not exceeding 120 or 125 pounds is required this type of boiler probably more fully meets general requirements than any other. Under the second head comes in the sectional or water tube type of boiler as manufactured by Babcock & Wilcox and many other firms in the same line. This sectional water tube type of boiler has been more extensively used, probably, than any other where high pressures were required, and it has in general cases met the requirements of this practice. We found, however, in some particular parts of our work, especially in power work, where the load is subjected to violent fluctuations, that this sectional type of boiler lacks steam room capacity to stand the violent fluctuations of load. This has caused engineers to look around for some other boiler which would combine the advantages of the horizontal return tubular and of the sectional. Without experimenting too much it seemed, on looking over the field, that the boiler which had been so largely developed for marine practice, as the internally fired marine type of boiler, offers the best solution of the difficulty with some modifications and changes. We therefore classify this as the third style of boiler adapted for this kind of work and have used it in this station. Its advantages in development for high pressures have been demonstrated by long experience, also for economy in space occupied, economy in operation and good steaming capacity. Such a type of boiler is described in the following specifications:

BOILER SPECIFICATIONS.

Type—Internally fired, direct fire tube marine boiler.

Pressure—To be tight under 160 pounds working pressure and tested to 210 pounds hydrostatic.

Capacity—To evaporate 8 pounds water from 100 degrees and 70 pounds pressure (M. E. unit) per square foot of heating surface. In other words, 10 square feet of heating surface per horse-power.

Economy—To evaporate 9 pounds of water from 120 degrees F. at temperature corresponding to 160 steam pressure per pound of good Scranton anthracite pea coal when developing its rated capacity.

Quality of Steam—The steam furnished by boiler when developing its rated capacity shall not exceed 2½ per cent of moisture as determined by calorimeter.

Furnaces—To be of either the corrugated or Adamson type, having a common combustion chamber.

Riveting—Longitudinal seams of shell to be butt jointed and and double butt strapped and triple riveted each side of butt. Circumferential seams to be double riveted. Flanges and heads to be single riveted. All holes to be drilled when sheets are in position for riveting.

Staying—Boiler to be stayed in the most approved manner to withstand 160 pounds working pressure. Strains on welded braces must not exceed 6,000 pounds per square inch section. Solid stays must not have strains to exceed 9,000 pounds per square inch of section. All stays, braces and rivets to be of the best double refined iron.

Manholes and Handholes—Each boiler to have at least four manholes to facilitate cleaning as well as a sufficient number of handholes for the same purpose.

Plates—All plates to be of the best marine steel of 60,000 pounds tensile strength.

Fronts—Each boiler to be supplied with neatly designed furnace fronts and cast iron bridge walls.

Fixtures—Each boiler to be supplied with necessary supporting lugs or saddles, one set of grate bars for each furnace, all necessary dampers, flue and cleaning doors and frames.

Fittings—Each boiler to be supplied with pop safty valve, steam gauge, water column, gauge cocks and stand pipes, asbestos blow off cock, stop and swinging check valves and necessary flanges for steam pipe connections riveted to boilers.

General Conditions—Boiler to be set to return the gases to the front underneath the bottom of the boiler. All material and workmanship to be first class in every respect and certificate of test and inspection furnished.

Remarks—That the type of boiler here specified has demonstrated its ability to perform its work is unquestioned; not only under the pressure specified and called for in electric service, but even the higher pressures used in the merchant marine today; taken in connection with its ability to work under high pressure successfully, it has good average economy. The other point that makes it most fitted for the service mentioned is the small space occupied, together with its enormous capacity or ability to furnish almost any amount of steam when forced, and this, too, of good quality as regards percentage of moisture. This, however, is easily accounted for by the large liberating surface at the water line. The firing of the boiler internally is another advantage offered by this type of boiler, when contrasted with the repairs necessary to furnaces, boiler settings, etc.

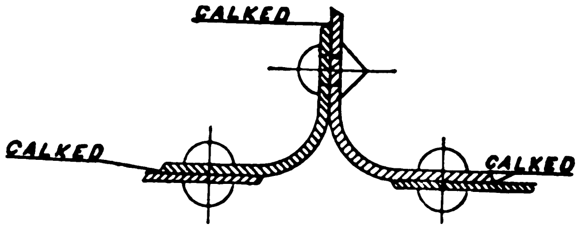


FIG. 6.

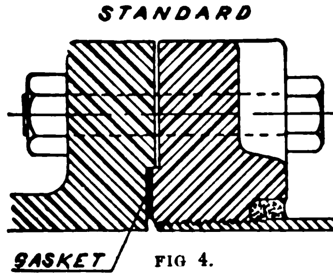


FIG 4.

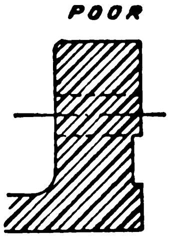


FIG. 5.

FIGS. 4, 5 AND 6.—AN IDEAL CENTRAL POWER STATION.

PIPING.

Piping is a part of the power station which, in the minds of many people, does not require much attention. We believe, however, that it is one which should receive the most careful and earnest attention of the constructing engineer. The safety, good working and reliability of a power station is dependent on the piping as much as any other factor in its outlay. We have tried to generally outline here, under the head of "piping," a few thoughts and suggestions which are supplemented by some sketches of what has been our practical experience of the requirements in this line.

PIPING SPECIFICATIONS.

Figs. 5 and 6 show a type of joint at flange on pipe to fittings or valves. The flanges are recessed, male and female, for gasket, to prevent the "blowing out" of the same. This effect is considerable if the gasket is thick. The flange is screwed on the pipe and then calked in on the inside. The small recess in the back of the flange around the body of the pipe is to be filled and calked with babbitt or steam metal in case of leakage of screw joint when circumstances will not permit, for the time being, to break the joint and recalk the pipe itself. The threads on the pipe should be cut by the same person, chasing the threads on flanges so as to secure the same taper on both; a very essential condition to a tight job. The screw joint should be made up in plumbago, to be removed, if necessary, at a future time without breaking. The flange should be designed to be equally strong through bolt holes as any other part of the flange. This is easily done by means of bosses about bolts.

There is one thing that should be remembered in the design of cast iron flanges, and that is that it is hardly possible to get them too heavy for the work. The initial strain due to screwing them on the pipe is so large that the factor of safety that remains is not usually sufficient to withstand the higher steam pressure, together with the increased expansive strains due to the increased temperature at the higher pressure. The weak point in the theory of cast iron flanges is as follows:

Conceive the flange to be made up of laminæ in the form of concentric circles. In case the first lamina is strained beyond its ultimate strength by screwing up, then although no disastrous results will be detected immediately the life of the flange will be very short, and it will fail by cracking, commencing nearest the threads i. e., at its smallest diameter and gradually radiating outward. This theory is similar to the one used in the design of hydraulic cylinders, and is equally applicable so far as screwing up the flanges is concerned. From this, one can see that it is possible to screw up a flange too tight; a fact too often overlooked in the anxiety to get a tight job, and usually done when the threaded work is poor.

Gaskets—Copper corrugated gaskets are all right in the case of mains, where the joints are made up with the ends of the pipe free to move; in fact, they could be omitted altogether in such a case, and the joint made iron to iron; but there is the practical consideration that in case of repairs (and that time is sure to come) the line will be always distorted from its original position; i. e., it will have initial strains, due to some part of it having steam on to run a portion of plant; and when the joint is broken for repairs, it is possible to bring the flanges back in the same relative position they previously occupied, and for this reason alone, I prefer the use of a wire insertion rubber gasket of very thin material, say not over 1-16th inch thick. This will make up, or rather allow, for this slight inequality of the flange facings, and permit a tight job to be made where a copper gasket or iron to iron would leak.

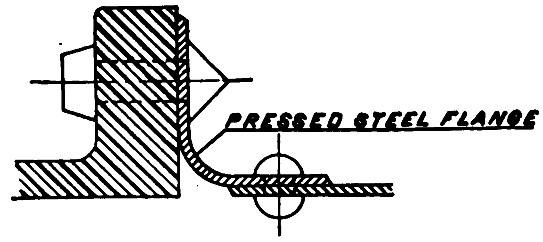


FIG. 7.

FIG. 7.—AN IDEAL CENTRAL POWER STATION.

Another type of connection for high pressure is shown in Figs. 6 and 7. The weak point in these designs is the fact that all calking is done from the outside at the joint, and that it makes a series of small traps for water of condensation. The system would give more trouble after it once commenced to leak than the one mentioned. The use of steel is good practice, and by making such a system with long radius bends of the pipe itself, would give good satisfaction.

Expansion Joints—The average slip joint will not answer at all for high pressure, for when the packing is adjusted sufficiently tight to prevent leaking, it will also be sufficiently tight to keep the joint from moving to take up the expansion, and if loose enough for this, it will be found to leak.

The corrugated copper expansion joint offers a solution to the difficulty of expansion joints, but when made as most of them are today in this country they almost defeat the object they seek to attain. The corrugations in these joints are made literally like the threads of a screw, whereas they should be made without longitudinal pitch, so as to prevent any torsional action tending to make them rigid. Probably the best way to take up the expansion in a high pressure system is by means of long pipe bends of easy radius, and with all branches so located, and of sufficient length to take any expansion of the mains by means of their flexibility on account of their small size. Judicious arrangement of this sort can be made without the use of any expansion joints whatever. Under restricted and peculiar conditions copper bends with iron bands can be used with good effect, if commercial considerations are not prohibitive.

Pipe—Wrought iron or steel lap welded pipe will answer most conditions successfully, even in case of long bends or elbows made from this material. The tests should be rigid to avoid defective seams caused by bending. Extra heavy pipe will not be found necessary.

Fittings—These should be of the best charcoal iron, true to pattern and of workmanlike finish. The flanges should be ribbed in preference to being thickened up, on account of shrinkage strains in metal.

Valves—There should be gate valves, operated by an outside screw. The spindle should be of steel, and tinned. The body should be extra heavy and ribbed to prevent any springing, which would cause the valve to leak around the seats when closed. The valve body should be stiffer than any other part of the system in order to have all the valves tight. The seats of valves should be bronze or brass, and able to withstand the high temperatures of the high steam pressures, as well as very non-corrodible.

All valves over 7 inches diameter of port should have a by-pass valve (a smaller valve about 1¼ to 2½ inches in diameter) of exactly similar type, so that the pressures can be equalized on both sides of the large valve before it is opened by means of the smaller one. This relieves the excessive strain on the spindles and seats and should always be used on high pressure work.

Support—A high pressure steam pipe should always be supported, when possible, from underneath, by means of some solid mass, so that its weight would rest directly upon this support. This method when it is possible to follow it, will be found to eliminate that vibration so often noticed, and the result of which is leaky joints caused by the racking and straining of the whole piping system. When the suspension method is used there is always one or two points which, if held firmly, will stop the vibration of the whole system. Other positions will cause a general leakage. Experiment will determine these points. Piping should be rigidly secured by proper means.

Bolts—All bolts should be of double refined iron or low grade steel. Their weakest point is directly under the head, and a good test is to place one in a vise, holding it by the head and bending the shank over by means of blows from a hammer. A good bolt should stand this without showing any cracks whatever at the head. Both head and nut should be hexagonal on account of the limited space in which it is often necessary to use a wrench. The whole system of piping should be blown out thoroughly with steam before the engine connections are made, to prevent any chips or dirt from being carried through to the cylinders.

GENERATORS.

In describing the type of generator required, it is necessary to be more specific as to the class of work it is required to perform, and particularly as regards the voltage, etc., than in our other departments. We will therefore in the main describe, as far as concerns the generator and switch-board, apparatus especially adapted for railway power service.

Generators for electric railway service should be constructed with a view to efficient handling of variable loads and excessive overloads for short periods. They should be mounted on a brick foundation set on a bed of concrete. The top of masonry should be provided with a wooden foundation base; this wooden base to be built up of two layers of timber, with tar paper or some good insulating material between the layers; the first layer bolted by means of foundation bolts direct to masonry, the upper layer being bolted to the lower layer, thus assuring good insulation between the iron foundation frame of generator and the ground. This precaution is taken with a view of protecting the generator from lightning coming in over the line.

Generator Frame in Belted Type—The foundation frame of the generator should be bolted directly to the wooden cap of the foundation and provided with grooves and sliding arrangement for tightening the belt. The general design of frame and magnets in the latest type of generators of large capacity is a circular casting built up of two or more parts and concentric with the shaft of machine. The pole pieces are in many cases made of laminated iron cast direct into this frame; the field wire, both shunt and series, being wound on adjustable spools, which, by suitable flanges and clamps, are bolted direct to the frame when slipped over pole pieces. The compound field of the machine should provide for sufficient fall in potential due to loss in armature at variable loads, and to maintain a constant electromotive force at the switch-board. The practice of over-compounding a machine so as to obtain an increased electromotive force with increased load—in some cases 10 per cent—is not a good method where a number of generators are in operation, for the following reason:

The machines over-compound in proportion to the load on themselves, and not in proportion to the load on any individual feeder, the result being that if, for instance two machines are running under condition of full load and have increased electromotive force 10 per cent at the switch-board, they may be feeding into two feeders; one feeder which is considerably overloaded, and the other which is very lightly loaded. The result is that the lightly loaded feeder is supplied with a high electromotive force, higher than necessary, and the overloaded feeder is the only one benefited. When the third machine is thrown into this combination the electromotive force is reduced, as the load is then divided between three machines instead of one, and consequently the overloaded feeder is not assisted to the extent which it was before.

A better method in large installations is to provide an auxiliary bus which can be connected at any time with any one or more generators, this auxiliary bus to be run at a higher electromotive force, say at 575 volts to 600, and run in connection with it the heavily loaded feeders, or those feeders which are of much greater length than the average of the system. This method reduces the quantity of wire required to run a system and maintains a fairly uniform pressure over the different lines. Arrangements should be made on the switch-board so that any feeder or any generator may be connected to or disconnected from this auxiliary bus, or to or from the main bus, the main bus to be run with an electromotive force of 500 volts, the same as in ordinary practice. In other words, this divides the switch board up into two distinct arrangements, electrically separated from each other. This has been tried in practice and has proved very satisfactory.

To return to the construction of the generator, the armature of the machine should be run in self-oiling bearings, made with adjustable globe seats, so as to insure perfect alignment, and provided in the larger sized machine with outboard bearing at the pulley end of the shaft.

The commutator should be of ample width to insure good contact service between commutator and brushes, for a 500 volt machine. Carbon brushes have proved very satisfactory, and are almost universally used at the present time. The machine should be so constructed that the brushes should not need readjustment for any change of load from zero to 25 per cent overload. There should be practically no sparking at the points of contact. The generator should be provided with a double pole switch, so as to enable the operator to disconnect the generator entirely from the system when it is required to do repairs, overhaul the machine or shut it down.

The generators should be capable of developing their normal output for a continuous run, and also capable of developing at least 25 per cent above their normal capacity for short periods without undue heating of any part of the armature, bearings or fields.

There are several methods of connecting the generators with the switch-board:

1st. The three wires from the machine, namely the positive, negative and equalizing wires, are all carried direct to a 3 pole switch; the equalizing wire is connected to an equalizing bus, and the ground wire to ground bus. The line wire of the machine from the switch is connected to an ampere meter and also to an automatic cut-out, and from there to the main bus. If an auxiliary bus is used the wire, instead of being connected directly to bus, is connected from the automatic cut-out to a transfer switch, which enables the wire to be connected through to auxiliary or the main bus. The main bus is in connection with a main ampere meter, the other terminal of the ampere meter being connected directly to the feeder bus. The feed wires are brought in the station to the switch-board and attached to a single pole switch; from this to an ampere meter, then through an automatic cut-out; then to the feeder bus, each feeder being provided with a lightning arrester. The line wire from the machine above described should be taken from the series field side of the machine, as this series winding affords a very good protection from lightning coming in over the line, acting as a very efficient "kicker coil." The ground bus should be connected direct to the rails near the station, and also to a suitable ground bus within the station.

To insure an equalization of load between the various generators all the dynamo mains of the same potential should be of equal resistance, provided the machines are of equal capacity, and have a resistance inversely proportionate to their capacity if of unequal capacity. The usual method followed is to calculate the size of the mains required for the generator farthest from the switch-board; then make the generator mains of the other machines of the same length as this, using the same size wire. In other words, all the positive mains will be of equal resistance, all the negative mains will be of equal resistance, and all the equalizing mains will be equal. It is not necessary to make the equalizing mains of any larger carrying capacity than the others.

Great care should be exercised in making joints between the different instruments and mains, to insure good conductivity, as a poor joint will throw the most careful calculations out. The usual method adopted now for making joints is to use a mechanical clamp having the contact surfaces perfectly clean and of ample surface contact. In operating the switch-board, care should be taken that all instruments required to be used to throw a generator in or out of line should be so arranged that the operator is not required to leave his position at the switch controlling the generator at the board. To obtain this result the volt meter may be arranged on a carriage which can travel along the length of the board and make automatic connection to any generator as it reaches a position exactly opposite the instruments connected with that generator. By suitable arrangement the volt meter can be switched, when in position, with the feeder bus, and also with the generator which it is to test, so that without moving the instruments, pressure of the line or pressure of the machine may be taken and the machine brought up to the same electromotive force of that of the line before being connected into service. The automatic regulators on the generator should be adjusted to cut out the generator when the overload of the machine is more than it will safely carry even for short periods. The automatic regulators on the feeders should be adjusted for an excessive overload on that feeder, as in many cases of railway service the feeder is subjected to excessive overloads for very short periods, and it is a source of great inconvenience to have an automatic regulator continually cutting out the line on overloads of very short duration.

The latest types of switch-boards are built up of fire proof material perfectly incombustible. The framework may be built up of iron pipe or of angle iron, and if located near the wall it should be set up at least twenty to twenty-four inches from the wall, and iron braces from top of frame anchoring into the wall. The general design of this frame is dependent entirely upon the number of instruments and their location on the board, as care must be taken that, with the present method of back connections on the instruments, the cross bars of the frame do not interfere in any way with the bare wire coming through back connections, and should be at a safe distance to prevent any danger from grounds. To this iron frame should be securely bolted large slabs of marbleized slate or white marble. Asbestos cloth or other cushioning device should be interposed between the slate and the contact points of the iron frame, so that the slate slabs may be securely fastened without risk of breakage. If slate is used, it should be carefully tested after all holes are drilled, to insure perfect insuation. All instruments to be used on board should then be connected directly to the slate slabs and not set on independent sub-bases unless absolutely necessary. As before mentioned, all connections on instruments should be made from the back on the board and no wiring exposed from the front. At the same time, all connections and wire should be so located as to be easily accessible for repairs or inspection. Where wires are passed through the floor below the switch-board, the holes should be fitted with a floor insulator of hard rubber made water tight, so that the floor beneath the switch-board may be kept perfectly clean, and, if any water accumulates it shall not be able to follow the wire down through the floor.

In addition to the foregoing arrangement of the switch-board, the following plan may be used: Instead of running three wires directly from each generator to a three-hole switch on the switch-board, take the equalizing wire from each machine and run to a common point, using a short bus, or any method of connecting which may be deemed most practical, so that all equalizing wires shall be of equal resistance to this point. Then take the ground main from the generator and run directly to the ground bus. The line main from the generator is then taken directly to the switch-board and connected to a single pole switch. From this switch connections will be made similar to the board already described. This arrangement provides a switch-board in which all wires are of the same polarity, and it insures a very safe method of operating. The only objection to this is that it is impossible to cut out the machine entirely from the switch-board, and it is therefore advisable in using this method to have each generator equipped with a double pole switch attached directly to the generator controlling both lines.

Regarding the grounding of positive or negative wire, a great variety of opinion is expressed by engineers as to the better method: some advising the grounding of positive, and others the neutral wire, the result which it is desired to obtain being a condition which will produce the least electrolitic action at contact points in the ground return, such as bond wires, supplementary, etc.

We have tried to outline in general here the important factors for consideration in an ideal central power station; our desire being more to lead up to general line of thought or discussion on the matter, and point out some of the most desirable features in relation thereto. If we have accomplished this, our purpose has been fulfilled.

Long Distance Electric Roads.

If an electric road of considerable length is not constructed and put in operation in the near future it will not be for lack of schemes looking to this end. Several projects of this nature are being pushed, and some of them are, apparently, quite near a realization to the extent that work has been begun on them. The most extensive perhaps of these projects is the Chicago & St. Louis, which it is proposed to construct on a system devised by Dr. Wellington Adams, and to which reference has been made before in these columns. Work has already been begun on the bed of this road. It is being pushed in both directions, and much of the right of way is reported as secured. Securities have been advertised for sale. It will be nearly 300 miles long, and it is proposed to make a speed of 100 miles an hour on it.

Perhaps the next most pretentious scheme, which has backing of well-known names, is that of the Washington & Baltimore Electric railway, which proposes to make a speed of about 60 miles an hour or a mile a minute. Some preliminary work, we are informed, has been done on this road, and its charter has been extended and surveys made for building the road to Philadelphia—three times as long as was originally proposed. A feature in connection with this project is the building of a grand boulevard connecting Washington and Baltimore, the electric road to be part of the boulevard system.

In Washington it is proposed to build an electric road connecting the cities of Tacoma and Seattle. The scheme of this road is not so much to make high speed as it is to develop the intermediate country. In western Massachusetts it is proposed to build lines connecting the electric roads of Springfield, Holyoke and Northampton; then by building branch roads connect all the larger adjoining towns. Some of these connections are now under way and others give evidence of being soon consummated, making, when completed, a system extending forty miles north and south and sixteen miles east and west, with the branches.

One of the leading electrical firms of Austria has recently submitted to the minister of commerce a project to connect Vienna with Buda-Pesth. There are some novel features in the system as planned, and the proposed system is being much discussed by electrical experts in Europe.

Strowger Automatic Telephone Exchange.

In the issue of ELECTRICAL INDUSTRIES for December, 1891, the Strowger automatic telephone which had just been patented and which was being put on the market by the Strowger Automatic Telephone Company, Chicago, was described and illustrated from the patent claims. During the months since then the company has been at work installing an exchange at La Porte, Ind., which is now completed and formally turned over for use.

This system has not been materially changed since it was patented, although some minor improvements have been made looking toward a greater efficiency of its working. Since the exchange at La Porte was opened the claims for this system have been verified, and it is reported as working to a high degree of satisfaction.

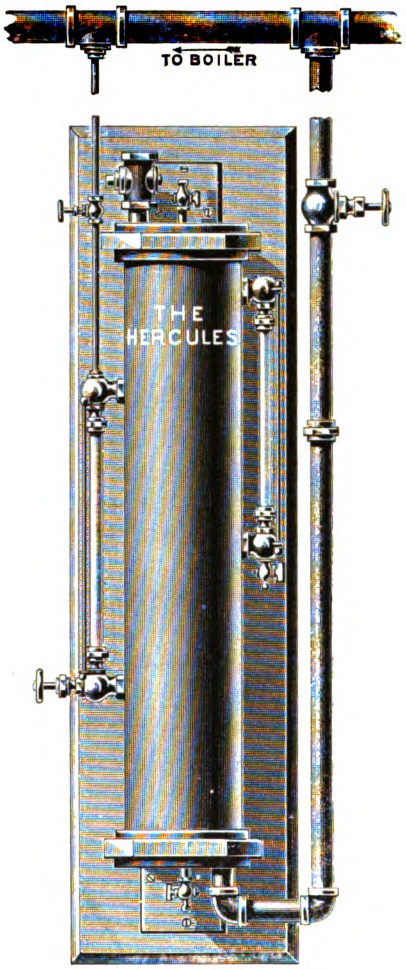
The purpose of this device, to do away with the central exchange, so that each subscriber may automatically connect himself with any other subscriber, has been accomplished without any hitch in the La Porte exchange, as also in the Fort Sheridan exchange, which the company has recently equipped and which has been accepted by the government. On each telephone are four or more keys, representing units, tens, hundreds, and, if needs be, thousands, while another key is "release." At the central office is the automatic device, by which the various connections signaled for are made by means of electro magnets, levers, pawls, and a shaft with ratchet wheels and a connecting arm. The armature of the units' magnet is fastened to the units' lever. To this lever is attached a pawl. This pawl engages the ratchet teeth of the units' wheel. The same is true of the tens and hundreds, so that when the signal is completed the central instrument makes the desired connection. There are as many machines at the central office as there are telephones, and each machine belongs to its particular instrument and has the same number. Thus, suppose number 25 wants to call up number 123. Number 25 presses his hundreds' key once, tens' key twice, units' key three times. In machine 25 at the central station, corresponding to his telephone, the arm is placed on contact point number 123, and the telephone is put in electrical circuit to 123. Now, to call 123, number 25 rings his bell, which rings up number 123. When the conversation is ended and the ear phones hung up, number 25 presses his release key, thereby actuating the release magnet on his central station automatic device, allowing the arm to return to its normal position, when the connection is broken.

The Strowger company has under consideration the equipping of four or five exchanges with this automatic system.

The Stowger company proposes to install one of its exchanges in the Electricity Building at the World's Columbian Exposition and has generously offered to connect the several exhibitors in the building one with another by this system. This will give the system a thorough test and at the same time demonstrate its practicability.

Hercules Boiler Scale Remover and Preventive.

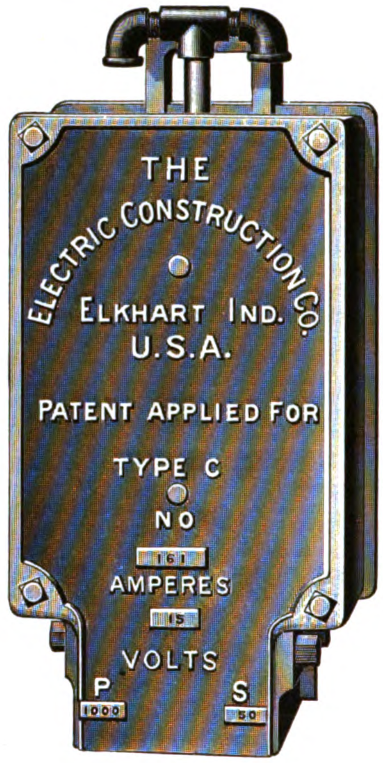
The subject of the proper care of a boiler is becoming more important yearly as units of power increase in size and as pressure is also increased. A finely equipped battery of boilers may be soon ruined by poor feed water if the proper precautions are not taken to prevent scale caused by impurities in the water. There are many methods offered to accomplish this. Perhaps the latest one is the Hercules shown in the accompanying illustration which is a purely mechanical device and has no secret or chemical process connected with it. This is attached to the feed water pipe and the cylinder is filled with ordinary kerosene oil. The device automatically injects the oil drop by drop into the feed water and the amount of oil to be injected can be easily regulated. The manufacturer is the Tryon Investment Company, New York City.



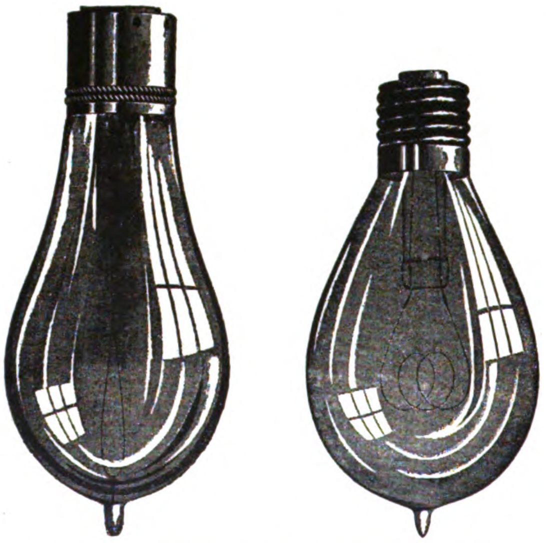
HERCULES BOILER SCALE REMOVER.

Elkhart Converter.

The Elkhart Converter, which has been prominently set forth in our advertising columns for some time, is being exploited in the west by the Electric Appliance Company, Chicago, and is deserving of some special mention. The general appearance of the machine is well shown in the accompanying illustration. In construction it is at once attractive, convenient and compact. The case, as is customary, is an iron waterproof shell constructed with a view to the least possible weight consistent with the necessary strength. Its special feature, however, is its electrical construction. The coils are wound in an oblong coil extending the full length of the case, the secondary being first wound on a form, and the primary wound over and upon the secondary. The iron is then built up inside and around the coils, the laminations being arranged in such a way that the joints are broken in every layer, i.e., the joints do not come in the same place in any adjacent laminations. The result thus attained is that the coils are surrounded entirely by iron, making the converter almost a solid mass of iron, but at the same time broken up in a way that effectively prevents the action known as hysterisis, which causes heating and magnetic loss. They are placed in neat iron waterproof cases, ready to install, as shown in the cut. The arrangement for fuses is of special construction, being a porcelain block with removable fuse cap, thus allowing fuses to be replaced with perfect safety.



ELKHART CONVERTER.



GENERAL ELECTRIC CO.'S IMPROVED LAMPS.

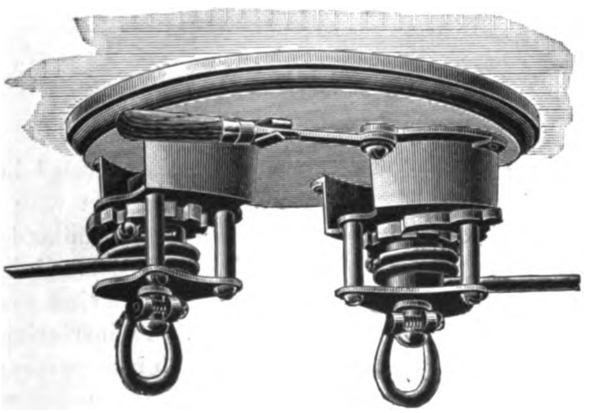
General Electric Company's Improved Lamps.

A high class incandescent lamp, especially adapted to the lighting of street cars, or for use on power circuits, has just been put on the market by the General Electric

Company. These lamps are of three special types. The first lamp is the straight unanchored filament lamp, differing no way in appearance from the ordinary incandescent lamp. This lamp is rated according to the amount of current consumed, and only those consuming the same amount of current should be used in any one series. In the anchored filament lamp the chance of breakage of the filament by sudden contact with the glass of the bulb caused by motion of the cars, is entirely obviated. The life of the lamp is, consequently, not exposed to abrupt termination or even abbreviation. The design of the spiral filament lamp is the most novel and most pleasing. As will be seen from the cut, the filament is made in three spirals, mounted on a heavy glass center, and requires no extra support. Great care is exercised in the manufacture of the two last named lamps in order to render the resistance exactly the same throughout each form, so that any "spiral" or "anchored" filament lamp may be used with others of similar form. Neither one, however, must be used in series with the others.

The "Lineman's Delight" Ceiling Board.

To obtain a straight and taut line wire, the lineman has considerable trouble, and has to use different tools, such as come-alongs, tackles, etc., which cause a waste of time, and yet do not give the satisfactory results, which can be obtained by using the ceiling board called "The Lineman's Delight," illustrated herewith. A glance will show the working of it. Place the ceiling boards in their proper position, where lamps are required and cut off pieces of wire reaching from one ceiling board to the following one. Then fasten both ends of the wire in the revolving binding posts of the two different ceiling boards, and wind those binding posts up with a wrench until the wire is taut. The dogs engaging the ratchet will prevent the unwinding of the wire. The lamps are hung in the usual way to the ceiling board. Each ceiling board is provided with a switch to take the lamps out of the circuit when it becomes necessary.



THE "LINEMAN'S DELIGHT" CEILING BOARD.

This ceiling board gives a straight and taut circuit, without the use of any insulators; it saves a great deal of time in construction; all kinds of wire, no matter how crooked can be used; wire can be removed instantly for the purpose of cleaning the ceiling, without any damage to the wire and board; and any person can handle it; he need not be an expert. This ceiling board is manufactured by Charles A. Pfluger, of the Standard Electric Company, Chicago.

To Make Residence Lighting Profitable.

The accompanying illustration shows the method proposed by Pitt Cravath, Whitewater, Wis., and manufactured by the Residence Lighting Company of Whitewater, for controlling electric current from a central station so that residence lighting may be made profitable to the station, and at the same time the user of the light have the current under his control and yet not be able to practice any fraud on the company. The diagram, Fig. 1, illustrates the application of the device to an electric light circuit. In this diagram A represents the dynamo or source of electricity; B B, the mains running from house to house; C C^1 C^2 C^3, etc., branch circuits, in which are included the lamps or other translating devices, D D^1 D^2 D^3, etc. Between one of the mains, B B^1, and the branch circuits, C C^1, is placed a multiple-contact, multiple-arm switch, E, consisting of a series of movable contacts, F, connected to the main circuit, equal in number to the number of lights for which the consumer contracts to pay, and so arranged as to make connection with a series of contacts, G, equal in number to the number of lights. Each contact, F, is independently movable in such manner as to make contact with any branch circuit contact, G.

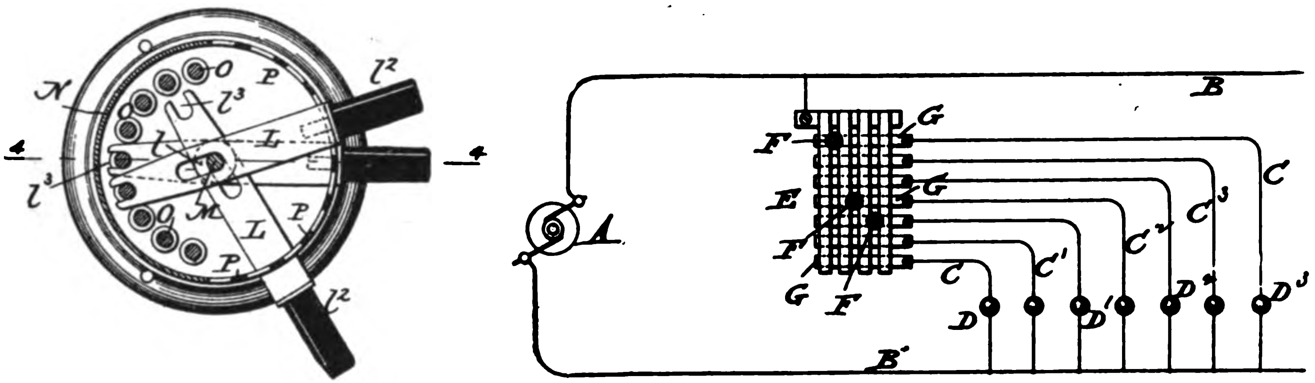


FIG. 2. FIG. 1.

TO MAKE RESIDENCE LIGHTING PROFITABLE.

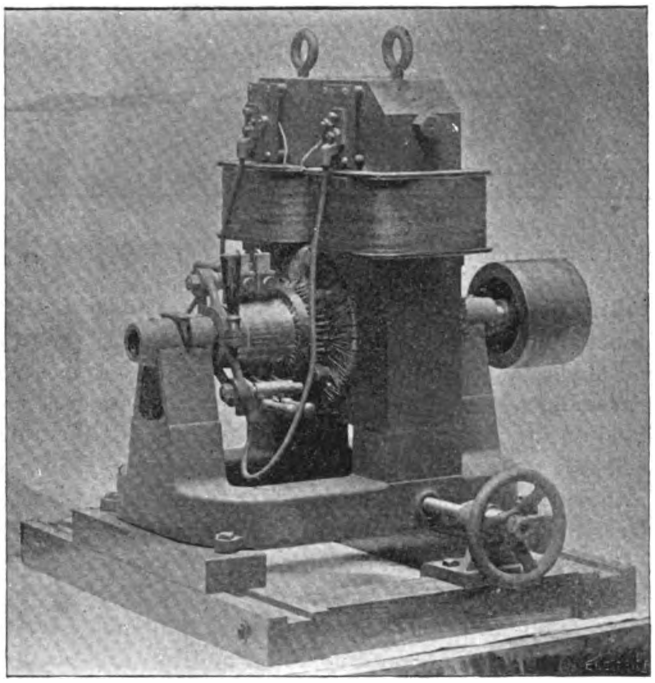
Fig. 2 shows a four-light switch with nine branch circuits, one form of the controlling device. In this switch L L L L represent slotted levers separated by washers l and swinging around the central pin, M; N represents the casing surrounding M and a series of upright rods, O, arranged opposite a series of slots, P. The ends of the levers are slotted so that they may grasp the upright rods, O, and make connection with them. The rods, O, are connected each with a separate branch containing lights, the other end of which branch circuits are carried back to the source of supply in the usual manner. If the consumer wishes to use any desired light he has simply to move the lever corresponding to the light desired to position indicated on the switch and it is impossible for him to use more than the number of lights corresponding to the number of levers in the switch. The switches can be made to suit different conditions and requirements.

Commercial Dynamos and Motors.

BY A. D. ADAMS.

Constant pressure dynamos and motors of moderate capacities may now be fairly said to have become a staple article of manufacture. In every large town and city hundreds and thousands of these machines may be found, doing the numerous classes of work for which they are adapted, silently, regularly and efficiently. The line of machines from ¼ to 50-horse power, manufactured by the Commercial Electric Company, Indianapolis, Ind., under the writer's patents, are designed to meet the exacting requirements of this use.

The aim in the design of these machines has been to produce only the best, and it is believed that this determination, coupled with several novel methods of construction, has resulted in a line of dynamos and motors having very desirable features, viewed from the users' stand-point. The following are some of the characteristic features of these machines. All field magnet frames are made of forged, wrought iron, throughout, no cast iron being used in them. As a result of this construction, a lighter, more sightly, more efficient machine is obtained. Probably no other company in the United States is using forged, wrought iron, exclusively, for field magnet frames.



COMMERCIAL ELECTRIC MACHINE.

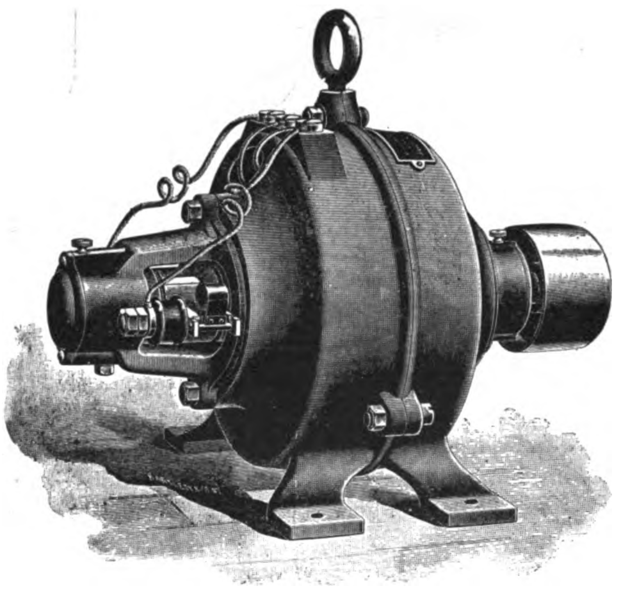
Gramme armatures of large diameter are used in machines from ¼ to 10-horse power, giving ample room for the many turns of wire required on these small machines for high pressure and insuring non-liability to burn-outs, and ease of repair. Armatures in machines from 1 to 10-horse power capacity are wound with but one layer of wire for the 110-volt pressure, and but two layers for the 220 and 500-volt pressure, another feature which renders burn-outs unlikely and repairs easy. The point of commutation is constant under all changes of load, within the capacity of the machines, due to the great strength of the field magnet and few turns of wire on the armature.

All starting boxes and rheostats are constructed entirely of incombustible material, with slate fronts. All terminal boards, for mounting connections on dynamos and motors, are of slate, and all binding screws and binding posts are of ample current carrying capacity and mechanical strength. All machines of 1-horse power and over are provided with insulated, sliding bases and belt tighteners.

The above points will, no doubt, be highly appreciated by those experienced in the setting up and operation of dynamos and motors. While field magnet frames, composed entirely of forged, wrought iron, are used almost exclusively for bi-polar dynamos by the best makers in England, makers in the United States are at present using this material throughout for field magnet frames. The writer ventures the opinion, however, that the next few years will witness the very general adoption of forged, wrought iron, throughout, for field magnets of constant pressure, bi-polar dynamos.

Small Lundell Power Motors.

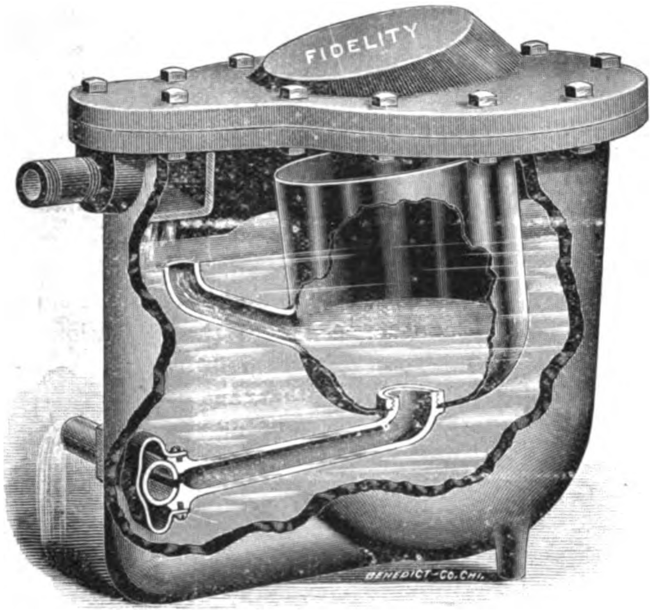
The Lundell fan motor which the Interior Conduit & Insulation Company, New York, put on the market last summer, and which was described and illustrated in the August issue of Electrical Industries, met with such favor that it created a demand for motors of similar design but of greater power. The result of this demand is the motor illustrated herewith which is made in sizes varying from one-quarter to five horse-power. In increasing the size of the motor it has been possible to incorporate some improvements which the small size of fan motor would not admit of, such for instance as placing the field coil concentric with the armature instead of oblique. The new construction permits the withdrawal of the armature without disturbing either the field coil or the pole pieces. The commutator is placed outside the field magnet shell but is well protected. Ready access to the brushes is thus afforded. This motor is a shunt wound one which pratically fulfills the duty of a differential motor. The company has in process of manufacture a complete line of smaller powers from the battery motor of one-twelfth horse power at four volts upward, including, one-tenth, one-eighth and one-sixth.



SMALL LUNDELL POWER MOTOR.

Fidelity Steam Trap.

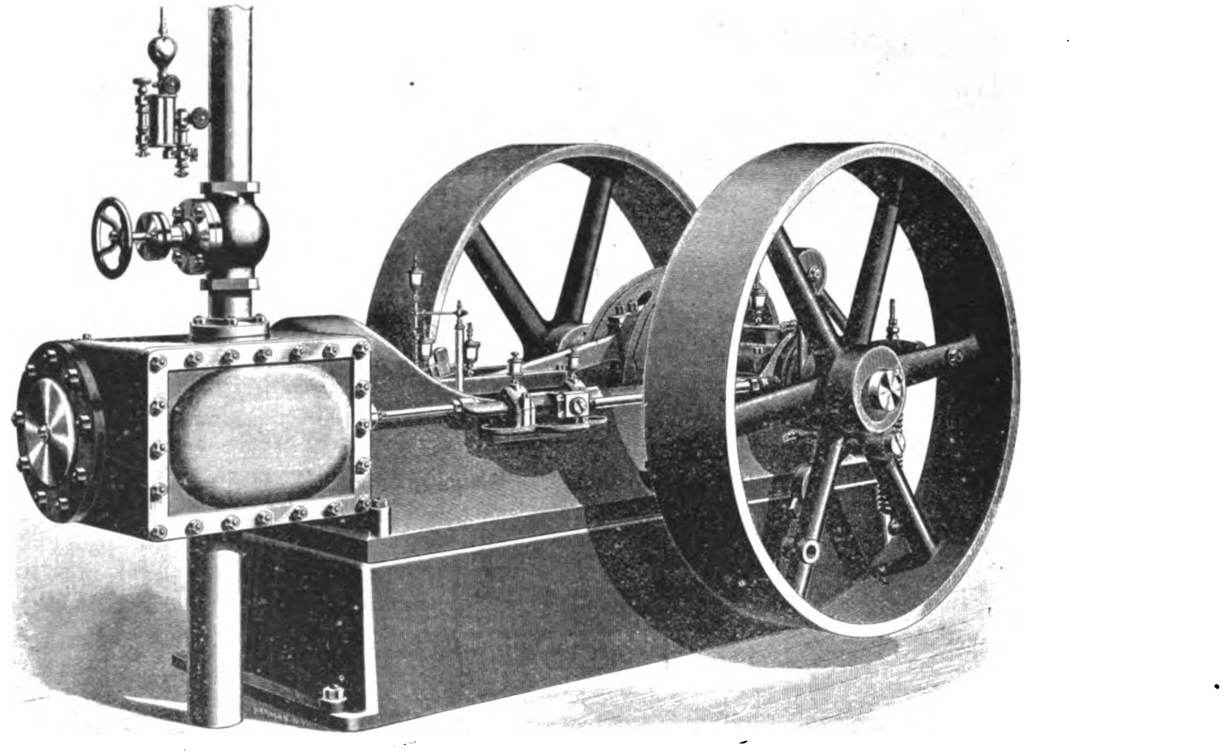
This trap is expressly designed for high pressure work, and is used extensively by electric light and power companies, and is made on the most practical and scientific principles. It has an open float and cannot collapse under any pressure, which is the main feature in traps for high pressure work. Having a rotary valve it wears its own seat and remains perfectly tight. Its action is thus: When sufficient water has passed into the float it will sink, thereby opening the valve and discharging the water at the same velocity that it enters it. It will lift water any desired height, according to the pressure carried, approximately two feet to every one pound pressure, regardless of the discharge. There are but few parts in its make up and therefore as to its construction little need be said. It will work wherever a steam trap is required, whether for high or low pressure. These traps are used by the Chicago Edison Company, where they are working on high pressure. The manufacturer is the Van Auken Steam Specialty Company, 201-207 South Canal St., Chicago.



FIDELITY STEAM TRAP.

Watertown High Speed Engine.

The Watertown Steam Engine Company, Watertown, N. Y., has designed and is now offering to the electrical trade the high speed engine illustrated herewith. In designing this engine the special aim has been, not only to maintain the perfect regulation demanded in electrical work, but at the same time to secure great economy in operation. The valve used in this engine has port openings so arranged as to admit steam to the cylinder ports through four different openings at once, thus giving the port opening four times the travel of the valve. The valve exhausts steam through four openings. On the back of the valve is a pressure plate which balances it. The governor is of improved construction and every part requiring oil is lubricated automatically. All links, levers and connections of the governor are of crucible steel. The frame of the engine is very heavy and the working parts are placed as low as possible.



WATERTOWN HIGH SPEED ENGINE.

St. Louis Electric Club.

The St. Louis Electric Club has leased and fittted up a fine suite of rooms in the Equitable building, corner Sixth and Locust Sts. The large assembly room is 60x40 feet in size, and is furnished with every possible convenience including electric lighting. The membership of the club is now over ninety. With the enthusiasm of the members and the elegant rooms occupied, the National Electric Light Association will have royal entertainment at the forthcoming convention.

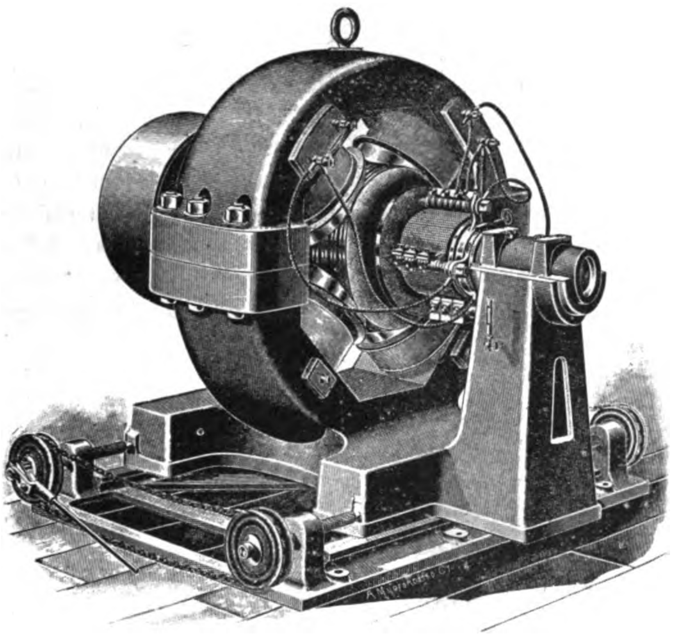
Prince Bismarck is reported to be a large stockholder in the Milwaukee, (Wis.,) Street Railway Company.

Mather Generator For Electric Railways.

BY PROF. WM. A. ANTHONY.

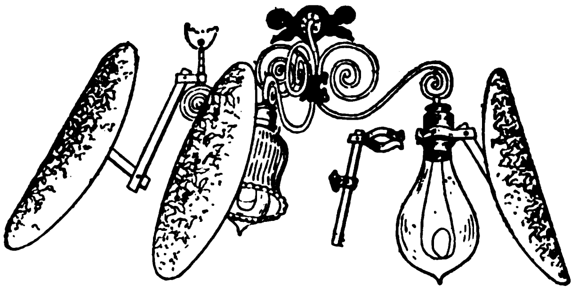
The special features of the dynamos manufactured by The Mather Electric Company, Manchester, Conn., has been the construction of field magnets without joints, and having a general form as nearly as possible like the natural one of the lines of magnetic force. Following out this principle of construction, the Mather incandescent dynamos have been made with cast iron field magnets of the well known ring forms, composed of one piece, and carrying the armature by means of yokes supported by steel bars passing through the poles of the magnets.

This form serves a most excellent purpose for incandescent dynamos, and although it seems to those who are not familiar with the mode of winding a difficult form to wind, it is really not so when wound for low potentials, but for high machines it becomes necessary, in order to avoid the strain on the field coils due to sudden changes of potential or breaking of the field circuit, to wind the wires in such a way that no two wires having any considerable difference of potential should be near each other. This necessitated the adoption of a form of field coil that could be wound in a lathe, with a single wire, in layers, and it was this necessity that led to the adoption of the form here illustrated of generators and motors. It was deemed very desirable to retain as far as possible the special features of the incandescent machines, and to this end designs were made to cast the field magnets in one piece, or, if joints are used at all, they are made by a cylindrical piece fitting into a hole bored in the casting and presenting a very large surface of contact so as to reduce as far as possible the magnetic resistance of the joints, and the machine has been so constructed that there were exactly the same joints in each of the magnetic circuits. By this construction there is a perfect symmetry of form in the several magnetic circuits of any one field magnet, and the different coils of the armature all pass through precisely equal magnetic fields. As a result of this arrangement there is absolute freedom from sparking at the commutator. In the four pole machines the armatures are so wound that there are only two paths for the current, but, at the same time, the winding is such and the commutator is so constructed, that opposite bars are joined by a cross connection.


MATHER RAILWAY GENERATOR.

The speeds of the various machines have been adjusted to the sizes of the armatures. The faster a generator or a motor runs, the greater is the output to be obtained, and the limit of speed is entirely a mechanical one. In designing these machines, it has been the aim to use as high a speed as is consistent with good mechanical principles, and it is believed that the speeds adopted will be found in every way more satisfactory than anything slower. Besides the advantage of greater output, the smaller number of windings upon the armature running at a higher speed presents very many advantages in smooth running at the commutator.

A very important factor in the construction of large machines is the quality of the sheet iron of which the armatures are made. Upon this a great number of experiments have been made, testing all iron in various ways, but especially by building up armature cores of half of one kind of iron and half of another, and running these armature cores before they were wound, in an excited field. This tests the iron under exactly the conditions to which it is exposed in practice, and if one end of the core was found to heat more than the other, the iron which heated less was, of course, the better iron. By such experiments as this an iron has been found which can be used for armature cores of twenty-four and thirty inches in diameter, running in intense fields and at speeds of 400 or 500 revolutions, with very little heating. This reduces the unknown losses in the running of the dynamo to a minimum, and the losses in the winding of the armature and field, which can be known to a fraction, become the greater part of the total loss when the machine is doing work. The Mather company claims a machine in which all the magnetic and electrical parts are absolutely balanced, a machine which will run at a perfectly safe and manageable speed, and give a large output for its weight, a machine which runs with absolute freedom from sparking at the commutator under greater variations of load, and has an efficiency at least as high as, if not higher than, any other similar machine in the market. The sizes of machines constructed for railway generators are 50, 75, 120, 180 and 225 kilowatts capacity. The last has six poles; the others are four pole machines.

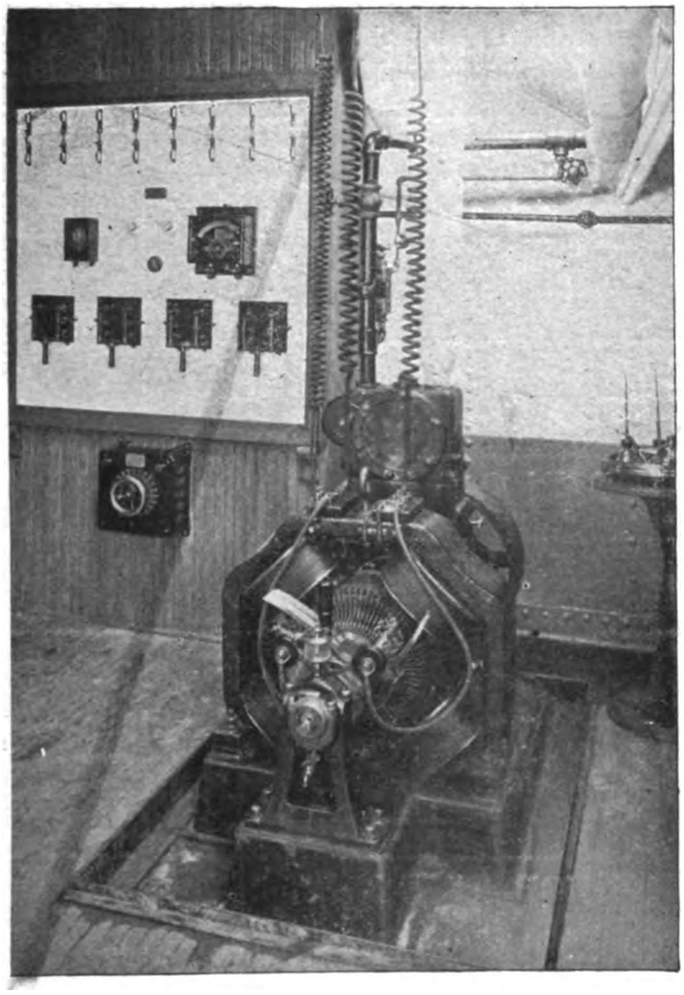

ST. JOHN ADJUSTABLE SHADE HOLDER.

St. John Adjustable Shade Holder.

In the accompanying illustration is shown a very simple adjustable shade, particularly adapted to use in connection with incandescent lamps. The holder of the shade is made of spring brass nickel plated and it can be adjusted to any position, protecting the eyes and yet not darkening the room. The shade is made of embossed tin the under side of which is finished very bright for a reflector. This device is manufactured by the St. John Specialty Company, Toledo, O.

Compact Direct Connected Generating Set.

The direct coupled generator and engine, illustrated herewith has recently been perfected and is now manufactured by the General Electric Company, New York. For marine installations, where a separate engine is indispensable to drive the generator these sets are especially adapted and they can be readily fitted to positions where a belt-driven dynamo and engine could not find a sufficiency of space. Their suitability for small isolated plants in buildings where belting is objectionable, is apparent. Under exhaustive tests, the engine shows the highest possible economy from machines of this size; and its simplicity is such as to reduce the attention necessary to a minimum.

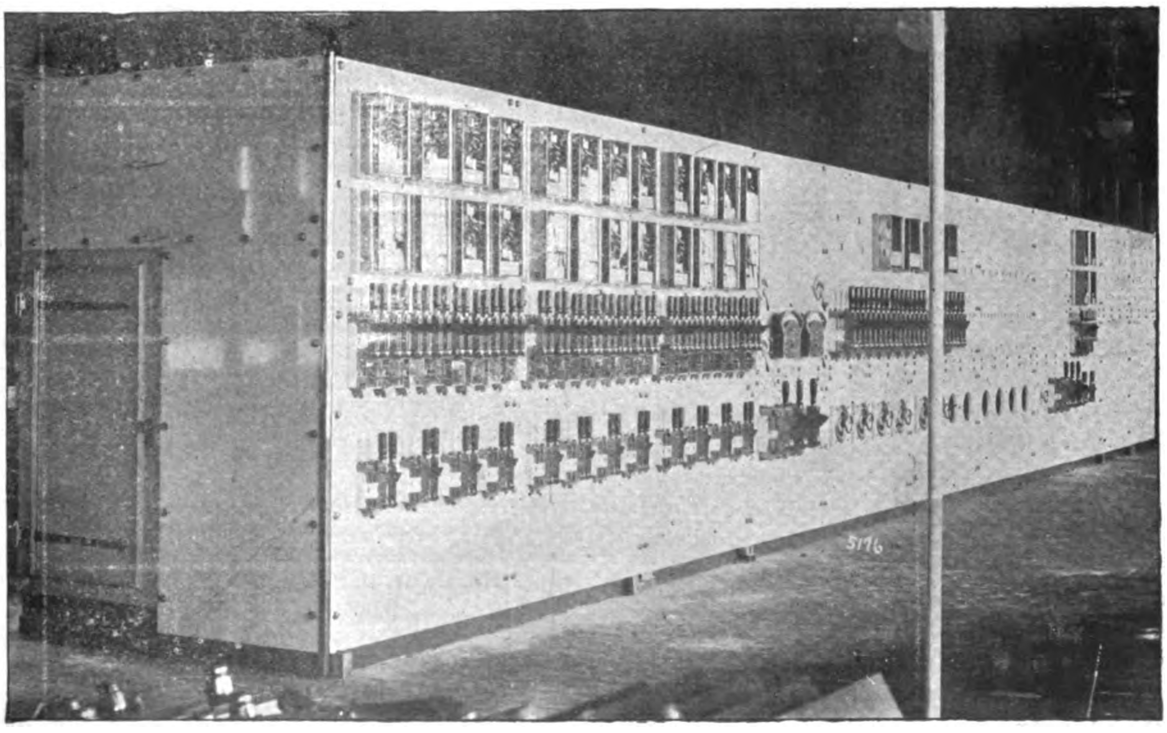


GENERAL ELECTRIC DIRECT CONNECTED SET.

The special advantages of this combination set, are shown in the plant herewith illustrated. This is the first electrical plant ever placed upon a vessel of the whaleback type, and was installed on the "Pillsbury." Considerations of space entered into the question of this installation as a room eight feet square was all that could be spared. The dynamo of the four pole type is of 150 lights capacity, and is directly coupled to a fifteen-horse power engine, both having a common bed-plate. Behind the engine and attached to the wall is the white marble incombustible switchboard. The vessel is wired in the usual manner for 150 lights. This installation, and that on the sister whaleback, the "Washburn," were effected by the Isolated Lighting department of the Northwest General Electric Company.

A Large Switchboard.

The General Electric Company, New York, has made a switchboard for the Edison Electric Light & Power Company, San Francisco, which is very complete as will be seen from the accompanying illustration. The board is one of the largest ones in existence, being 56 feet 8 inches long and constructed of slabs of polished Italian marble mounted on an iron frame. It provides for the distribution of 14,666 amperes at 150 volts from twelve General Electric multipolar generators directly coupled to triple expansion engines. The busbars are so arranged that the station can be operated under four different potentials at the same time. The board provides for 24 feeders, each feeder being equipped with two ampere meters and three switches. All connections are made on the back of the switchboard.



A LARGE SWITCHBOARD.

Diamond Transformers.

The tendency in transformers is toward improvement over what a short time since was considered the standard, and the Diamond transformer exemplifies this. Fig. 1 shows the transformer as it appears attached to the cross-arm on the pole. It has the requisite hooks for engaging with the cross arm and a large ring in the top to hoist it into position. Fig. 2 shows the interior of the fuse box. The porcelain fuse blocks are connected directly with the door of the fuse box, so that when it is opened all connection is broken and a lineman may readily replace fuses on a live wire without the slightest danger of accident. The Diamond converter has a very high efficiency, a regulation within 2 per cent and leakage current low. The wires on the secondaries can be used either for 50 volts or 100. This is accomplished without the necessity of a switch.

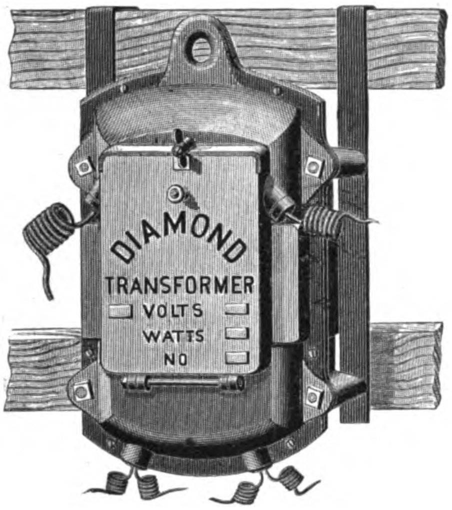


FIG. 1,—DIAMOND TRANSFORMER.

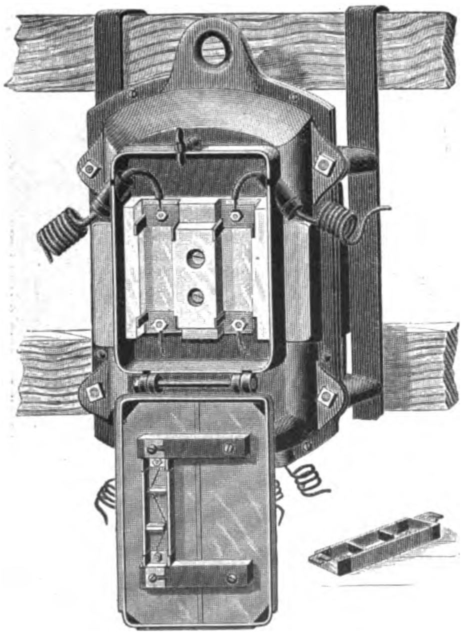


FIG. 2.—DIAMOND TRANSFORMER.

The cardinal feature of this transformer, however, lies in its separable coils. Fig. 3 shows the coils. The secondaries are made in two parts bolted tightly together and thereby completing a perfect magnetic circuit. Should, however, there be a burn-out, it would only be necessary to replace the coil. Taylor, Goodhue & Ames, 827 Monadnock block, Chicago have taken the exclusive selling agency for these transformers.

Queen's Standard Ballistic Galvanometer.

In the accompanying illustration is shown a new ballistic galvanometer that has just been put on the market by James W. Queen & Company, Philadelphia. By grading the coils their electro-magnetic action has been increased from that obtained with ungraded coils of the same total resistance in a ratio of 9 to 4.

The instrument embodies one of the most important improvements to galvanometers which has been made for many years, viz.: the method of varying sensibility within the widest limits, without "drift."

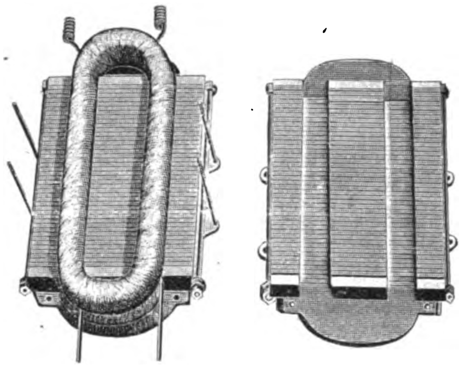
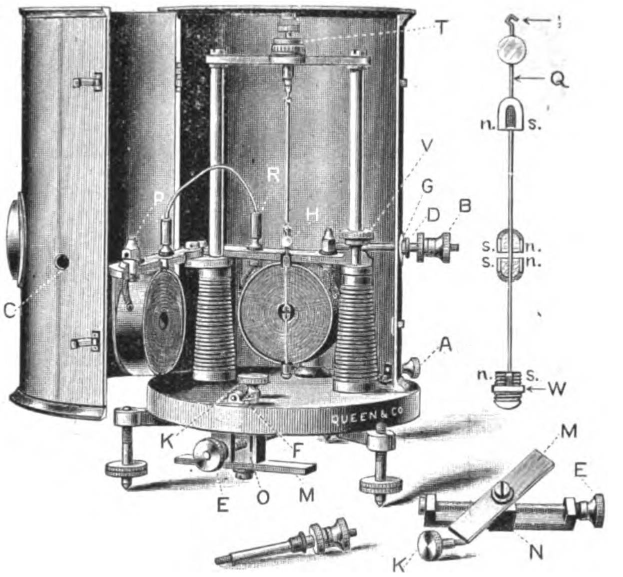


FIG. 3.—DIAMOND TRANSFORMER.

A regular light suspension is also provided to be substituted for the ballistic system, as both have hooks resting in corresponding hooks attached to the fibre and can be interchanged very readily. As usually supplied the coils are wound with a total resistance of 500 ohms. Interchangeable coils of greater capacity will be supplied to order.



QUEEN'S STANDARD GALVANOMETER.

Heating and Ventilating is the title of a new monthly publication which is to be built up from another journal. Mr. L. H. Hart formerly business manager of the *Electrical World*, will run the new paper with Mr. H. M. Swetland as general manager.

A new journal enters the electrical field with the opening of the new year. It is entitled *World's Fair Electrical Engineering* and is published and edited by Mr. Fred DeLand, who has been connected with electrical interests for a number of years and who is well known from having represented the *Electrical World* in the west until last month. Mr. DeLand has made a thorough study of matter pertaining to the Exposition and will no doubt benefit electrical interests by publishing in full, all that pertains to electricity at the Fair.

Leading Articles of the Electrical Weeklies During December.

ELECTRICAL ENGINEER.

Burke Cable Relay and Transmitter, The. Illustrated. Dec. 7th.

Arc Lamps for Optical Projection. Illustrated. By R. S. Dobbie. Dec. 7th.

New Method of Field Excitation, A. Illustrated. By H. L. Tyler. Dec. 7th.

First Electrical Treatise of Galvani, The. By Park Benjamin. Dec. 7th.

Increased Commercial Efficiency and Higher Economy in Central Stations. IV. By J. H. Vail. Dec. 7th.

On a Method for Balancing Armeture Reactions. By Harris J. Ryan. Dec. 7th.

Lake Roland Elevated Railway, The, Baltimore. Illustrated. By A. V. Abbott. Dec. 7th.

Use of Compound Wound Generators from a Practical Point of View, The. By M. Willis. Abstract. Dec. 7th.

Magnetic Field, The. By Prof. E. J. Houston. Abstract. Dec. 7th.

Life Work of Werner von Siemens, The. With portrait. Dec. 14th.

Curve for Ascertaining the Ampere Turns Required for Magnetic Saturation, A. By Chas. Steinmetz Illustrated. Dec. 14th.

Engineering Details of the New York-Chicago Long Distance Telephone Line, The. By Jos. Wetzler. Illustrated. Dec. 14th.

Sheridan Electric Power and Office Building, Denver, Colo., The. Illustrated. Dec. 14th.

Life of Incandescent Lamps in its Relation to Mercury and Metallic Vacuum Pumps, The. Illustrated. By G. A. Frei. Dec, 14th.

On a Novel Type of Unipolar Machine. By Wm. A. Carey. Illustrated. Dec. 14th.

Leonard's System of Control for Electric Driven Cranes. Illustrated. Dec. 14th.

On the Dissipation of Electrical Energy of the Hertz Resonator. By V. Bjerknes. Illustrated. Dec. 14th.

Genoa Continuous Current Transformer, The. Illustrated. Dec. 14th.

Edison Sawyer Man Lamp Case, The. I. II. Dec. 14th, 21st.

On the Dissipation of the Electrical Energy of the Hertz Resonator. By Nikola Tesla. Dec. 21st.

Tables Showing Permissible Amperage and Depth of Wiring for Cotton Covered Wire. By Walter S. Dix. Dec. 21st.

On the Exact Adjustment of Standards of Resistance and the Determination of Temperature Co-efficience. I. Illustrated. Dec. 21st.

Rope Driven Electric Plant of the Racquet Club, New York City. The. Illustrated. Dec. 21st.

Differential Wattmeter for Alternating Currents, A. By A. E. Kennelly. Illustrated. Dec. 21st.

Simple Magnetic Detector, A. Illustrated. By J. B. Williams. Dec. 21st.

Irish's Closed Conduit for Electric Railways. Illustrated. By W. E. Irish. Dec. 21st.

Wynne System of Electric Traction, The. Illustrated. Dec. 21st.

Insulation Resistance of Cotton and Silk Covered Wires. By T. T. P. Luquer. Illustrated. Dec. 28th.

Entities, Magnitudes, Quantities, and Units. By E. Hospitalier. Dec. 28th.

Method of Wiring a Building with Conduit. Illustrated. By P. C. Oscanyan. Dec. 28th.

Empirical Formulæ for H-B. Curves of Magnetization. By Chas. E. Emery. Dec. 28th

On the Operation of Electric Light and Railway Plants from the same Station. By H. K. McCay. Dec. 28th.

Micanite for Armature Insulation. By Edward P. Thompson. Dec. 28th.

THE ELECTRICAL WORLD.

Alphabetical Index by Subjects for Practical Men. By F. G. Bolles. Illustrated Dec. 3rd.

Applications of Electricity to agricultural work. I. II. III. IV. Illustrated Dec. 3rd. 10th, 17th and 31st.

Separable or Detachable Incandescent Lamps. Illustrated. By Dr. L. K. Bohn. Dec. 3rd.

Experimental Studies of the Differences of Potential Generated through Contact of Metals, Liquids and Dry Electrolytes. II. III. IV. By Walter Negbaur. Dec. 3rd, 10th and 17th.

Electrical Needs of the Times. I. II. By H. Franklin Watts. Dec. 3rd, 17th.

Chronological History of Electricity. Part II. 1800 to 1820. By P. F. Mottelay. Dec. 3rd, 10th, 17th, 24th, 31st.

Oil versus Air as an Insulating Medium. II. III. By James Bowstead Williams. Dec. 3rd, 10th.

Cost of Electric Supply, The. I. II. III. By Dr. John Hopkinson. Dec. 3rd., 10th, 24th.

Use of Compound Wound Generators from a Practical Point of View, The. W. M. Willis. Dec. 3rd.

Notes on the Effect of Harmonics on the Transmission of Power by Alternating Currents. By Henry A. Rowland. Dec. 10th.

The Modern Development of the Dynamo. By Prof. W. Kohlrausch. Dec. 10th.

Induction Motor. Who Invented It? The. By Rankin Kennedy. Illustrated. Dec. 10th.

Useful Transformer, A. By Giulio M Appolonj. Illustrated with diagrams. Dec. 10th.

Test of an Improved Parsons Condensing Steam Turbine. Illustrated. Dec. 10th.

Performance of an Overhead Traveling Crane Operated by a Single Electric Motor. By Anthony Victorin. Dec. 10th.

South Staffordshire Electric Road, The. Illustrated. Dec. 10th.

Commercial Electrolysis. II. III. By Emile Andreoli. Dec. 10th, 17th.

Experiences with Primary Batteries. By George H. Lee. Dec. 17th.

Fallacies in Dynamo and Motor Design, The. By F. B. Crocker. Illustrated. Dec. 17th.

Open and Closed Magnetic Circuit Transformers. Dec. 17th.

Life and Efficiency Tests of Incandescent Lamps. By Clarence P. Feldmann. Dec. 17th.

Edison Lamp Patent Suit, The. Dec. 17th.

Advantage of Forcing Lamps at the Expense of their Life. By Carl Hering. Dec. 24th.

Non-polarized Ammeters. By Clarence E. Gifford. Dec. 24th.

Incandescent Lamp Patent Case, The. From Text of the Opinion. Dec. 24th.

Effects of Induction and Distributed Static Capacity in arc-conductor, The. By Frederick Bedell and Albert C. Crehore. Dec. 24th.

Fuse Wires. By C. P. Feldmann. Illustrated. Dec. 24th.

Experimental Researches on Alternate Current Transformers. By Dr. J. A. Fleming. Dec. 24th.

Electricity at the World's Fair. Illustrated. Dec. 3rd, 10th, 17th, 24th, 31st.

Generating Power at the Coalfields and Transmitting it Electrically to Industrial Cities. Dec. 31st.

Silvey System of Electric Lighting for Railway Trains, The. Illustrated. Dec. 31st.

Ideal Central Power Station, A. By C. J. Field, E. J. Cook and F. Bourne. Dec. 31st.

Micanite, A New Insulating Material for Armatures. By Edward P. Thompson. Dec. 31st.

WESTERN ELECTRICIAN.

An Electric Excavator. Illustrated. Dec. 3rd.

Electric Signalling through Fire Hose. Illustrated. Dec. 3rd.

Johnston Elevated Electric Road. Illustrated. Dec. 3rd.

The Compound Winding of Generators from a Practical Standpoint. By M. Willis. Dec. 3rd.

Rae's New Electric Railway System. Illustrated. Dec. 3rd.

Oil Versus Air as an Insulating Medium. II. By James Bowstead Williams. Dec. 3rd.

Electricity at the World's Fair. Illustrated. Dec. 3rd, 10th, 17th, 24th, 31st.

Electricity in Japan. Illustrated. By Kunikiko Iwadare. Dec. 10th.

Electric Cranes in Railroad Shops. Illustrated. Dec. 17th.

Electric Power for Cotton Mills. Abstract. By C J. H. Woodbury. Dec. 17th.

Indications of the Shifting of Neutral Points. By C. O. Poole. Dec. 17th.

Direct Water Driven Dynamos from Switzerland. Illustrated. Dec. 24th.

The Therapeutic Effects of the Alternating Current. Dec. 24th.

Factory Driving by Electricity. Illustrated. Dec 24th.

M. M. M. Slattery, with portrait. Dec. 24th.

An Ideal Central Power Station. Illustrated. By C. J. Field, E. J. Cook and F. Bourne. Dec. 31st.

THE ELECTRICAL REVIEW.

Electric Railways—I. II. III. By T. J. McTighe. Dec. 3rd, 10th, 17th.

Commercial Electrolysis. By Emile Andreoli. Dec. 3rd.

Letters from a Laboratory. XXIII. XXIV. XXV. XXVI. XXVII. By Julian A. Moses. Dec. 3rd, 10th, 17th, 24th, 31st.

Electricity in the Art of War. I. II. III. By Lieut. C. D. Parkhurst. Dec. 3rd, 17th, 24th.

Hudson River Telephone Co. Illustrated. Dec. 10th.

Medical Electricity. Dec. 3rd, 10th, 17th, 31st.

Telephone in Sweden, The. Illustrated. By Hjalamer Van Kohler. Dec. 24th.

Incandescent Lamp Case, The. Dec. 24th.

Variable Speed Power Transmission. By H. C. Spaulding. Dec. 24th.

Micanite for Armature Insulation. By Edward P. Thompson. Dec. 31st.

Steps in the Electrical Progress of 1892. Dec. 31st.

Regulation Test of the Ryan Special Series Motor. By W. L. Bliss. Dec. 31st.

ELECTRICITY.

Massachusetts Fair. II. III. By W. S. Key. Illustrated. Dec. 7th, 14th.

The Cost of Electric Supply. By Dr. John Hopkinson. Dec. 7th.

Electric Motors in Factories. I. II. By R. H. Housman. Dec. 14th, 21st.

Christmas Electricity. Illustrated. Dec. 21st.

Electric Heating. By P. K. Stern. Dec. 21st.

Forgotten History—Moses G. Farmer's Early Work. By W. S. Key. Illustrated. Dec. 21st.

Directo-Alternating Current Transformer. Illustrated. Dec. 28th.

Electricity on Board Naval Vessels. Illustrated. Dec. 28th.

Capt. A. de Khotinsky, with portrait. Dec. 28th.

Micanite for Armature Insulation, I. By Edward P. Thompson. Dec. 28th.

An Ideal Central Power Station. I. By E. J. Field, E. J. Cook and F. Bourne. Illutsrated. Dec. 28th.

THE ELECTRICAL AGE.

Smoke Consumption. Dec. 17th.

Decision in the Lamp Injunction Case. Dec. 24th.

Micanite for Armature Insulation. I. By Edward P. Thompson. Dec. 31st.

ELECTRIC LIGHT AND POWER.

EXTENSIONS AND IMPROVEMENTS.

St. Charles, Ill.—The municipal plant proposes to install 100-horse power in a boiler and an engine and a 1,000 light alternating dynamo.

Birmingham, Ala.—The Consolidated Electric Light Company, which now has its arc and incandescent plants separate, contemplates combining them in one station and making other improvements. J. F. B. Jackson is manager.

Little Rock, Ark.—The Little Rock Edison Electric Light & Power Company will add a new engine and two dynamos to its plant. J. A. Van Etten is purchasing agent.

The arc lighting capacity of the Little Rock municipal plant is to be increased to 200 lights and change made from 20 to 10 amperes in the circuits. G. E. Fish is superintendent.

Taylorville, Ill.—The Taylorville Electric Company has ordered a 100 horse power boiler to increase its power plant. J. N. C. Shumway is purchasing agent.

Missouri Valley, Ia.—The Missouri Valley Electric Light Company will add an arc system to its plant. C. H. Duer is purchasing agent.

Spencer, Ia.—The Spencer Electrical Company is installing an 80-horse power engine and will double the capacity of its plant. A. W. Miller is president and purchasing agent.

Winona, Minn.—The Winona General Electric Company will acquire the properties of the Winona Electric Light Company and the Winona City Railway Company and build and equip a new station in the early spring. George C. Duffie is president.

Telluride, Colo.—The Telluride Electric Light & Power Company has in contemplation some improvements and extensions to its plant. C. W. Corbin is acting manager.

North Manchester, Ind.—The Jenney Electric Company contemplates installing an alternating plant of about 600-lights capacity. J. W. Boyer is manager.

Thompsonville, Conn.—The Enfield Electric Light & Power Company will probably add several more arc lamps to its circuit for street lighting purposes. L. A. Upson is purchasing agent.

Negaunee, Mich.—The Negaunee & Ishpeming Street Railway & Electric Company has purchased the plant of the Ishpeming Gas & Electric Light Company and will merge its station into its own. A. Maitland is president.

Vincennes, Ind.—The Vincennes Citizens' Street Railway Company is contemplating constructing lighting circuits in connection with its railway system.

Lonaconing, Md.—The Lonaconing Electric Light & Power Company contemplates doubling its present lighting facilities. J. J. Bell is manager and purchasing agent.

Beatrice, Neb.—The Beatrice Rapid Transit & Power Company is rebuilding its station recently burned, and will re-equip it.

Hudson, Mass.—The Hudson Electric Light Company will build a new station and add more apparatus, considerably increasing its capacity. F. S. Dawes is president and purchasing agent.

Boston, Mass.—The Brookline Gas Light Company, address 1 Beacon St., is considering installing the two phase alternating system, utilizing the same circuit for both light and power. C. S. Crehore is the purchasing agent.

Frederick City, Md.—The Frederick City Electric Light Company will install a new dynamo. This is a municipal plant, J. F. Eisenhauer being purchasing agent.

Pittsburgh, Kas.—The Pittsburgh Gas Light & Coke Company will increase its boiler capacity. Harry Hess is superintendent.

Indianapolis, Ind.—The Indianapolis Light & Power Company is building a new plant, which it hopes to have in operation in February. At first only an arc plant will be operated, but it is proposed soon to install a large incandescent plant. T. A Wynne can give information.

Salem, Mass.—The Salem Electric Lighting Company has largely increased the capacity of its plant, and is considerably extending its circuits. S. Fred Smith is manager and purchasing agent.

Boonville, Ind.—The Boonville Electric Light & Power Company will considerably increase its incandescent lighting and correspondingly increase its converter capacity. C. M. Hammond is manager and purchasing agent.

Santa Cruz, Cal.—The Santa Cruz Electric Light & Power Company is developing a large water power in order to operate its plant by water wheels. F. W. Swanton is manager and can give information.

Cherokee, Ia.—The Cherokee Electric Light & Power Company will increase the capacity of its plant by installing an incandescent dynamo and a new engine. J. C. Hutchison is manager.

Iowa City, Ia.—The Climax Electric Light Company is extending its circuits and will otherwise improve its plant. Thomas Evans is manager.

Mt. Carmel, Pa.—The Edison Electric Illuminating Company is about to install an arc lighting plant of 30 or 40 lights capacity for purposes of street lighting.

Oregon, Ill.—Jones & Hastings have contracted to increase the capacity of their alternator and will otherwise improve their plant. F. G. Jones is manager.

Sunbury, Pa.—The Edison Electric Illuminating Company will at once double the capacity of its plant in every respect the work to be completed by March 1st. C. J. Callahan is manager and purchasing agent.

Peru, Ill.—The municipal electric light plant, of which Theodore Weberling is purchasing agent, has just installed a 100-horse power Buckeye engine and two 25 K. W. Edison dynamos.

Pottstown, Pa.—The Pottstown Light, Heat & Power Company has made contracts for one 250-horse power cross compound Ball engine, one 1,500 light Westinghouse alternating dynamo and one 50-light Thomson-Houston arc dynamo. L. W. Byers is superintendent.

Deadwood, S. Dak.—The Black Hills Electric Light Company is building a new plant and installing 300-horse power engine capacity.

Chicopee, Mass.—The Chicopee Electric Light Company has just installed a 50-light arc dynamo. David Boynton is superintendent.

Chelsea, Mass.—The Chelsea Gas Light Company is increasing its boiler and engine capacity. Geo. W. Moses is manager.

Green River, Wyo.—The Green River Electric Light & Power Company is installing an incandescent plant. J. T. Wyche is superintendent.

Philadelphia, Pa.—The Columbia Electric Light Company will increase its boiler, engine and dynamo capacity. F. E. Coward is manager and purchasing agent.

Middletown, Pa.—The Municipal Electric Light Plant will add a 150-horse power engine; also a 1,000-light alternating dynamo and 50-light arc dynamo to its plant. W. J. Sheldon is manager and purchasing agent.

Kewanee, Ill.—The Kewanee Electric Light Company contemplates a considerable addition to its lighting capacity in the spring.

Martinsville, Ind.—The Martinsville Electric Light & Power Company contemplates some improvements and extensions to its plant next month. H. A. Smock is manager and purchasing agent.

New Organizations.

Cleveland, O.—The Universal Electric Company, 741 Cedar Ave., is seeking franchise to establish an electric light plant. N. S. Possons is president and manager.

Toulon, Ill.—The Toulon Light & Power Company has been organized and contemplates installing a lighting plant at once. M. A. Fuller can give information.

Portland, Me.—The Columbian Light & Power Company has been organized with Isaac C. Atkinson as manager. A plant will be installed at once.

Concord, N. H.—The Concord Lighting & Water Power Company will build and equip an electric light plant, which is to be in operation in the early spring. L. J. Odell is manager.

Clinton, Wis.—The Standard Electric Company, of which Louis Lusk is manager, is equipping an electric light station, which is to be in operation this month.

Newark, O.—The Newark & Granville Electric Light Company has just put its lighting station into operation. W. C. Christian is purchasing agent.

Ansley, Neb.—The Ansley Electric Light & Power Company of which C. J. Stevens is president and purchasing agent has just completed and put its light plant into operation.

Hollidaysburg, Pa.—The Hollidaysburg Electric Light &

Power Company, operating both arc and incandescent systems, has just been put into operation. W. F. Taylor is manager and purchasing agent.

South Norwalk, Conn.—The municipal lighting plant has been put into operation. The authorities are contemplating doing commercial incandescent lighting in addition to arc street lighting. W. L. Bonnel is superintendent.

Duquesne, Pa.—The Duquesne Heat, Light & Power Company has put its new plant into operation. F. A. Stattenfield is superintendent.

Nevada, Ia.—The Nevada Electric Company of which T. L. Seevers is president has just been put into operation.

York, Pa.—The Westinghouse Electric Light, Heat & Power Company is building and equipping an electric light plant which is to be in operation early in January. L. A. Marshall is president.

Redlands, Cal.—The Redlands Electric Light & Power Company has been organized and will build and equip an electric light plant, both arc and incandescent, to be operated by water wheels. Few if any contracts are yet made. H. H. Sinclair is president.

Dawson, Pa.—The Dawson Light & Power Company is building and equipping an electric light station which it is hoped to have in operation in January. P. G. Cochran is president and purchasing agent.

Catonsville, Md.—It is proposed to build and equip an electric light plant here, the company to have a capital of $25,000.

Tucson, Ariz.—The Electric Light & Power Company of Tucson has been organized, with Albert Steinfeld as president, and is building and equipping an electric light station which it is hoped to have in operation in a month or so.

Rice Lake, Wis.—The Rice Lake Water Works Company, of which W. H. Willard is manager, has established an electric light station which went into operation in December.

Columbus, Kan.—The Columbus Light & Power Company is building and equipping an electric light plant to be in operation soon. A. H. Crowell is manager and purchasing agent.

Anderson, Ind.—A municipal plant is being established here, operating both arc and incandescent systems. J. H. Terhune is manager.

Heppner, Ore.—The Heppner Light & Water Company is building and equipping an electric station which is to be in operation soon. T. W. Ayers is president.

Little Rock, Ark.—The City Electric Street Railway Company proposes to install a lighting plant. H. P. Bradford is manager.

Hartford, Vt.—The Hartford Electric Light & Power Company will build and equip an electric light plant installing first an alternating incandescent system and later an arc system. No contracts are yet awarded.

Bangor, Pa.—The Bangor Electric Light & Power Company is installing an arc, also an alternating incandescent plant. W. A. Stocker is superintendent and purchasing agent.

Hartford, Ind.—The Hartford Electric Light Company is installing a plant to use both arc and incandescent systems. G. E. Reynolds is superintendent.

Madison, Wis.—The Four Lakes Light & Power Company is building and equipping an electric light station. F. W. Hoyt is secretary and can give information.

Syracuse, N. Y.—The Onondaga Electrical Company has been organized with A. N. Palmer secretary. Contract has been made to equip a plant, which is to be in operation about May 1st.

THE ELECTRIC RAILWAY.

EXTENSIONS AND IMPROVEMENTS.

Negaunee, Mich.—The Negaunee & Ishpeming Street Railway & Electric Company contemplates building extensions to its lines aggregating about three miles. J. B. Maas is treasurer and secretary.

Lawrence, Mass.—The Merrimac Valley Street Railway Company contemplates building a line from Lawrence to Haverhill in the early spring. N. E. Morton is superintendent.

Bloomington, Ill.—The Bloomington City Railway has been granted permission to relay its lines with T rails. Other improvements are also in contemplation. W. H. Patterson is manager.

Marlborough, Mass.—The Marlborough Street Railway Company will extend its lines in the early spring to Marlborough Junction, a distance of about a mile. The company has also been granted right to extend its lines to Westborough and Hudson, a distance of about ten miles. H. E. Bradford is manager.

Washington, D. C.—The Glen Echo Railroad Company will extend its lines about two miles. Edward Baltzley can give information.

San Francisco, Cal.—The Metropolitan Railway Company will build a plant, install a 600-horse power engine and purchase 18 new cars. H. A. Iddings is superintendent.

Ellwood, Ind.—The Ellwood Electric Street Railway Company will extend its lines so that when completed the line will comprise six miles. J. E. Jeffries is manager.

Binghamton, N. Y.—The Binghamton Railroad Company is building a new power station, double tracking its line, and will make other improvements. J. P. E. Clark is manager.

Oak Park, Ill.—The Cicero & Proviso Street Railway Company will add to its plant one 600-horse power engine and two Edison generators.

Burlington, Ia.—The Burlington Electric Railway Company will probably extend its lines to West Burlington, a distance of three miles. F G. Jones is manager.

Kankakee, Ill.—The Kankakee Electric Railway Company has under consideration the extension of its lines to North Kankakee, a distance of about two miles. C. H. Cobb is president and manager of the road.

South Bend, Ind.—The South Bend & Mishawaka Railway Company is relaying its entire line with 65-pound T rails and will increase its number of motor cars; also duplicate its power plant. J. Mc M. Smith is president.

Ft. Scott, Kas.—The Ft. Scott Rapid Transit Company will build a mile or more extension to its lines. W. D. Mitchell is superintendent.

New Organizations.

Reynoldsville, Pa.—The Reynoldsville & Rathmel Electric Railway Company has been incorporated with F. K Arnold as president. It is proposed to build 3½ miles of line, but no contracts are as yet let.

Athens, Pa.—The Athens, Sayre & Waverly Electric Street Railway, Light & Power Company has been organized and will at once build a plant. F. S. Kinner can give information.

Atlanta, Ga.—The Atlanta City Street Railway Company has contracted for part of its electrical equipment, and will probably be in operation in May. Aaron Haas is president.

Toronto, Can.—The Toronto & Scarboro Electric Railway, Light & Power Company has been organized, with D. G. Stephenson, as president. It will begin the work of construction in the early spring, and proposes to build 20 miles of road.

Patterson, N. J.—The Patterson & Little Falls Electric Railway Company hopes to have its line in operation within a month. John R. Beam is secretary.

St. Louis, Mo.—The Clayton & Forest Park Railway Company will build six miles of line. But few contracts are as yet let. Thomas K. Skinner is president.

Bellwood, Pa.—The Juniata Valley Electric Railway Company has been organized, with Edgar B. Kay as manager. It is proposed to build an electric road of about 15 miles, connecting Bellevue, Altoona and Bellwood.

Hazleton, Pa.—The Hazleton & South Side Electric Railway Company, of which A. Markle is president, is about making contracts for the equipment and construction of a railway.

Vicksburg, Miss.—The Vicksburg Electric Transit & Light Company contemplates building about five miles of railway. No contracts have yet been let, nor has a system been chosen.

NEW BOOKS.

The Mineral Industry, Its Statistics, Technology and Trade in the United States and Other Countries from the Earliest Times Until the Close of 1892. Published by the Engineering and Mining Journal, New York. Price $2 in paper and $2.50 in cloth.

This great work is the annual statistical supplement to this journal, and is not only a complete review of the mining interests of the United States and all other countries for the past year, but also of the latest advancement and improvement in methods of mining. The latest scientific investigation of Europe and America is reported. Stocks and other securities, and other data of value to the mining interests are fully covered. The volume will be ready for delivery the latter part of this month.

Electricity and Magnetism, by Edward J. Houston. Published by the W. J. Johnston Company, Ltd., New York. Price $1.

This book just from the press is Prof. Houston's latest work, and is a series of primers of electricity. It is designed to supplement the general knowledge of electrical matters that most people who read anything of electricity now possess. The volume comprises 300 pages, in addition to a complete index. The subject matter is very lucidly written, and the ordinary reader could scarcely fail to comprehend it. Only one who is master of the science, as is Prof. Houston, could make himself so understandable. The book is designed more for the student and for such work as university extension work than as one of instruction to practical work in electricity. Still, any one interested in electrical matters would find much in the volume to make a study of it well worth while.

Standard Tables for Electric Wiremen, by Charles M. Davis. Third edition, revised and edited by W. D. Weaver, published by the W. J. Johnston Company, limited, New York. Price $1.

This is a pocket size volume, concisely arranged so far as its reading matter is concerned, and is designed to be of a thoroughly practical character and ever ready for wiremen and electricians. The wiring tables have been recalculated on a basis of 55 watt lamps, and a valuable table has been added to the volume, by means of which the tables of the three standard voltages can be used for any other voltage, and also for any other drops than those in the tables. The methods for determining the sizes of conductors is standard, while the wiring formulæ for motor circuits are reduced to their simplest practical form. Horse power formulæ, rule for safe wiring and other valuable information are included. The volume is one that should be of much practical value to workers in the electrical field.

Tips to Inventors, by Robert Grimshaw. Published by the Practical Publishing Company, New York. Price $1.

The writings of Mr. Grimshaw on practical subjects, especially in a mechanical line, are among those best known to the reading public, so that the author of this book needs no introduction to the public. And as for the title of the book, the whole story of the volume is told in the words "Tips to Inventors." The book classifies the several lines of inventions, and tells in what directions inventions are most needed, and at the same time points and ideas are given as to how to perfect and develop new ideas in any line. Mr. Grimshaw starts out with a purpose to warn inventors away from fields in which remuneration is doubtful, and direct effort in the direction in which there is most promise. In this effort he is consistent, and an inventor can hardly fail to get valuable suggestions from these pages. In the line of electrical inventions the author is especially explicit.

Dynamo Machinery, by John Hopkinson, published by the W. J. Johnston Company, Times Building, New York. Price $1.

This volume of 250 pages is a collection of papers written by Mr. Hopkinson and delivered before eminent scientific societies in Great Britain. Mr. Hopkinson is an interesting investigator, and writes of the results he secures in a comprehensive manner. Students will find this volume interesting from the manner in which the experiments made are written out in detail; but so far as practical workers in electricity are concerned, there is not so much of an instructive nature to them, unless they desire to go into the subject deeper than most of them have time. There are eleven papers altogether in the volume. The first three refer more especially to the study and design of dynamos; the fourth and fifth discuss the theory and design of continuous current dynamos; in the sixth paper the subject of coupling alternating current machines together is considered; the three following papers discuss the subject of transformers; the tenth paper relates to the alternating current dynamo, and the last one to electric lighthouses. The whole subject is made much more instructive than it otherwise would be by the use of illustrations, which number nearly 100, and by mathematical formulæ. Dr. Hopkinson is well known as a writer, and as these papers are published for the first time in book form, and in an authorized edition, we doubt not but what they will be extensively read.

The official volume containing the reports of the thirteenth convention of the National Electric Light Association, which was held in Providence, R. I., February 17, 18 and 19, 1891, as published by order of the executive committee, is just at hand. It is a neatly printed and nicely bound volume, and on account of the valuable information it contains, should be in the hands, not only of every member of the Association, but also of every electric light man for the value of the papers and discussions. Correspondence in regard to this volume should be addressed to the secretary, George F. Porter, 136 Liberty St., New York.

TRADE PUBLICATIONS.

A convenient and serviceable card and memorandum case is being distributed by the Watertown Steam Engine Company, Watertown, N.Y. It is made of linen, and is substantially bound with leather.

A convenient pocket sized illustrated catalogue of the machinists' tools manufactured by F. E. Reed & Company, Worcester, Mass., is at hand. This company manufactures a full line of lathes, milling machinery, and other apparatus particularly adapted for use in repair shops connected with electric light and electric railway stations. Nearly every well regulated electric station finds it necessary to have some of these machines at hand for repair work, and a catalogue of this nature is very valuable for reference in ordering machinery.

The arc lighting apparatus of the Standard Electric Company, of Chicago, has become so generally known, and so many inquiries have been received since the award to this company of much of the World's Columbian Exposition lighting contract, that it has found it necessary to issue a catalogue briefly describing and illustrating its apparatus. Several valuable patents are delayed in the patent office, so that the catalogue is by no means as complete as it otherwise would be. Yet it tells to the central station manager a very interesting story of this popular apparatus. It is a nicely printed and published catalogue.

Electric heating, as done by the Burton electric heater, is fully and interestingly described in a pamphlet just issued by Taylor, Goodhue & Ames, Monadnock Building, Chicago. This pamphlet describes this method of heating for street cars, steam railway cars, dwellings, stores and offices, as well as for household uses. Full instructions are given for connecting the heaters in electric cars, also comparative cost of these heaters in operation with stoves. The Burton heater has been introduced on many railways throughout this country and Canada, and many testimonials are published from users of it showing the success that has been attained. The pamphlet is very neatly printed and arranged.

A handsomely printed and bound catalogue has been issued by Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., illustrative and descriptive of its electric apparatus, incandescent, power and arc. An interesting description is given of the introduction of the alternating system and of the progress it has made, and the whole subject of electric apparatus is presented in a manner to at once attract a person interested in an electric station. The dynamos, meters, converters, lamps, sockets, switchboards, arc lamps, all come in for detailed description, while the direct current system manufactured by this company is also fully described and illustrated. There is a great deal of instructive matter contained in these pages. In every respect it is a highly creditable publication, and one that cannot fail to be appreciated for its intrinsic worth.

The subject of the economic transmission of power is fully and completely considered in an attractively printed catalogue issued by the Shultz Belting Company, St. Louis. In its 72 pages is a great amount of information concerning belts, this being the fourth edition of this company's catalogue, but much enlarged in its scope. All the necessary information regarding the management of belts, their care and preservation, is given in articles from the pens of eminent writers. The several styles of belts manufactured by the Shultz company are described and illustrated completely, and the large factory where the belts are made is shown in a full page illustration. Not only is the catalogue very attractive, but it is also very useful for the amount of practical information it contains. It would be quite invaluable to any engineer or manager of a power transmitting plant where belting is used.

PERSONAL.

Mr. J. . McGraw, of the *Street Railway Journal*, was in Chicago for a few days last month.

Mr. Charles Newton, of the Jewell Belting Company spent a few days among friends in Chicago last month.

Mt. M. E. Baird, of the Eddy Electric Manufacturing Company was in Chicago last month looking after important business matters.

Mr. L. W. Collins has been appointed western representative of the Electrical Engineer, to succeed Mr. W. Forman Collins, resigned.

Mr. J. F. Kester has resigned from the Kester Electric & Manufacturing Company and will soon have ready for the market a line of electric specialties.

Mr. W. Forman Collins, who has represented the Electrical Engineer in the West for some time, has resigned and associated himself with the Western Electrician as business manager.

Dr. J. Allen Hornsby, secretary of the department of electricity, World's Columbian Exposition, has been recommended by the council of administration for promotion to the positon of assistant chief of the department. This is a worthy recognition of the excellent work Dr. Hornsby has done.

Mr. E. E. Higgins, who has long been connected with electric railway matters, and until lately general manager of the Short Electric Railway Company, has opened an office at 35 Wall St., New York, and will act as financial counsel in street railway matters. Mr. Higgins' intimate acquaintance with street railway matters will be of much service in his new business.

BUSINESS NOTES.

The Pullman Palace Car Company, Chicago, has received an order from the South Chicago Electric Railway Company for forty open cars of ten seats each.

The Electric Appliance Company, 242 Madison St., Chicago, reports large sale of its new Acme wire guard for incandescent lamps, many orders for it being placed by eastern jobbers.

The Caldwell Water Tube Boiler Company, 15 Cortlandt St., New York, has been awarded contract for supplying 600-horse power in boilers by the Metropolitan Realty Company, for its new fourteen-story building in New York City.

The Harter Electric Company, Chicago has been recently organized by G. A. Harter as president and manager. Mr. Harter is well known in electrical circles in the west, and his new company will do an electrical engineering and construction business.

The Great Western Electric Supply Company 203 S. Canal St., Chicago, has closed a very successful year. Assistant General Manager T. C. Rafferty thinks a statement of the year's business a very gratifying present to the stockholders of the company.

Priestman & Company, 150 South Third St., Philadelphia, are experiencing much interest in their recently invented kerosene burning engine. At the meeting of the Franklin Institute, Dec. 21st, Dr. Coleman Sellers read an interesting paper regarding this engine.

The National Electric Manufacturing Company, Eau Claire, Wis., has had such a demand for its apparatus in the east that it has found it necessary to open a branch office at 620 Atlantic Ave., Boston. H. F. Holland, formerly of the Germania Electric Company, has been appointed district agent.

The Lunkenheimer Company is the name the Lunkenheimer Brass Manufacturing Company, Cincinnati, will be known by hereafter. The company has increased its capital stock to $500,000, and will at once extend its manufacturing facilities correspondingly, and also soon place on the market several new specialties.

The Chicago Rawhide Manufacturing Company, Chicago, is as usual busy in filling orders for goods of its well known manufacture, which includes rawhide goods of every description. Just now the company is especially busy in filling several large orders for its foreign trade which is a very important part of its business.

Alfred F. Moore, corner of Third and Race Sts., Philadelphia, Pa., has purchased the plant, machinery, materials, patent rights, etc., of the Globe Electric Cordage Works, Philadelphia, which have been manufacturing all kinds of flexible cords for electrical purposes. Mr. Moore proposes to push this line of business energetically.

Queen & Company, Philadelphia, are meeting with success in exploiting their standard portable testing sets. One purchaser says: 'The set has been in use constantly since we received it, and we find it to be first-class in every respect." Another writes: "It has won our confidence to the extent that we accept it as a standard, not only as a portable instrument, but in a greater share of our laboratory work and electrical measurements. It is correct to within a small degree, easily manipulated, and results quickly obtainable, and can say that we do not know of one single point left to be desired in this instrument for an instrument of this nature." These instruments are made in a strictly first-class manner, and are adapted for use under the most exacting conditions, such as in a man hole or close to dynamo machinery. They are fully described in circular 285 issued by the makers.

The C. & C. Electric Motor Company, New York, is making an interesting installation of motors for the Water Power & Investment Company at Gothenberg, Neb. This installation comprises these motors: One five-horse power, three ten-horse power, one twenty-five-horse power, two thirty-horse power and one one hundred horse power.

The Shawmut Fuse Wire Company, whose office has been at 85 Water St., Boston, Mass., has been compelled by the increased volume of its business to take larger quarters, and is now situated at 161 High St. In their new quarters the company has greatly increased facilities are had for filling orders for tested fuse wire, fuse links, etc.

The Central Electric Company, Chicago, owing to the great increase of its business in Interior conduit, Johnson switches and the Lundell motor, for which it is general western agent, has been compelled to create a separate department for these goods, and has placed Mr. H. H. Small in charge. Mr. Small was formerly with the General Electric Company, and is well known in that connection.

G. S. Sering, 1417 Monadnock building, Chicago, has taken the western agency for the Hart switches, which are manufactured by the Hart & Hegeman Manufacturing Company, Hartford, Conn. These switches are well known to the readers of Electrical Industries. Another specialty which Mr. Sering will handle will be the St. John adjustable shade advertised elsewhere in these columns.

The Belknap Motor Company, Portland, Me., has received some very flattering testimonials regarding its B. C. standard motors and dynamos. A few of these testimonials have been published in circular form reporting high efficiency in the use of these machines. The dynamos are made in all sizes from five light capacity up and the motors from one eighth of a horse power to any reasonable size.

The Ries Electric Specialty Company, Baltimore, Md., is determined that its regulating socket shall be as highly perfected as possible. On December 27th two patents were granted Mr. Elias E. Ries, president of the company, covering broadly this socket. These patents show various types of sockets in which the principle of counter E. M. F. is employed for regulating the brilliancy of the light.

The National Electric Manufacturing Company is having a business boom at its Cincinnati office of which Mr. G. P. Altenberg is manager. Mr. Altenberg reports that his sales in September were 420 per cent as compared with August, 10 per cent greater in October than in September, 30 per cent greater in November than in October, and in the first 20 days of December exceeded the entire month of November.

The McGuire Manufacturing Company, of Chicago, the well-known manufacturers of electric railway trucks, has among other recent orders, sold trucks as follows: South Chicago City Railway Company, ten No. 19 F motor trucks, forty No. 10 trail trucks; Springfield, Mo., twelve motor trucks; Bay City, Mich., twelve motor trucks; Huntington, W. Va., four motor trucks; Marion, Ind., two motor trucks.

The Siemens & Halske Electric Company, Monadnock building, Chicago, is pushing work in its new factory with all despatch. Inquiries and orders for apparatus make it necessary to have the plant in operation at the earliest moment possible, and there is hope that everything will be in readiness in a month or so. The company will then be in position to push even more energetically its lighting and railway systems.

The Tryon Investment Company, 14th Street and 10th Ave., New York City, reports many inquiries for its boiler scale remover and preventive. This mechanical device works so simply and is so easily adjusted that the company is receiving many inquiries from electric stations about it. So confident is the company in the efficiency of the device that it offers a 30 days trial of it, and if the results are not satisfactory, pays all charges for transportation.

The Electric Gas Lighting Company, Boston, of which Mr. L. W. Burnham is vice president and general manager, reports that its business during the past year has increased over 25 per cent and that in order to better accommodate this rapidly growing trade it is now moving its factory into much larger and broader quarters. This increase is certainly remarkable when it is considered that competition in the line of the specialties made by this company has been most bitter, a thing which is to be regretted. Good goods, however, tell their own story and the company is to be congratulated upon its success.

The Electric Appliance Company, 242 Madison St., Chicago, has rounded out its first year of business and is receiving many congratulations and compliments upon the success it has attained. During the year the company has acquired a list of specialties that are not only well known but that are also excellent sellers. But not content with the results already obtained, the company will offer several new specialties to the trade as a beginning for the new year. One of its latest specialties is an improved ceiling cut-out with removable cap. The cap is attached without screws by a quarter turn to the right and detached by a similar turn in the opposite direction. To prevent the possibility of the cap jarring loose, which has been the great difficulty in other cut-outs of this style, a supplementary phosphor-bronze spring has been added, making loosening almost an impossibility. The cut-out is placed on the market under the name of the Acme ceiling cut-out. A year ago the Appliance company made a great hit in electrical toys and novelties for the holiday trade. This year it went into the same line more extensively than before with even more satisfactory results.

The Detroit Electrical Works, Detroit, Mich., have just closed contract through their special agent, L. E. Myers, of their Chicago office, with the Calumet Electric Railway, Chicago, for ten 100 K. W. generators, twelve 40 horse power car equipments, and an expensive and handsome switchboard which is to be very complete. Mr. Myers has also closed contract with the Bell City Railway, Racine, Wis., for six 40-horse power car equipments and two 100 K. W. generators.

A. S. Aloe & Company, 415 North Broadway, St. Louis, Mo., are meeting with much success with their converters for purposes of surgical and other such light work. They can be used with either 104 or 52 volt alternating circuits. Converters are also made to use with direct currents. The alternating converter is wound for five volts, although the usual cautery electrode requires a current of but about 2¼ volts and 18 amperes. All the necessary accompaniments for surgical purposes are made to go with these converters.

The Watertown Steam Engine Company, Watertown, N.Y. has been obliged to open headquarters in Chicago in order to handle its western business more thoroughly, and has put Mr. Albert Fisher in charge of the agency. Mr. Fisher is widely known in this trade in the west from his former connection as general western manager for the Ball Engine Company. The new high speed engine which the Watertown Engine Company has just put on the market is attracting attention of engineers because of its economy, combined with its perfect regulation.

The Standard Railway Supply Company, Monadnock building, Chicago, which put its new car stove on the market last fall, has met with marked success, and already has it in use on over fifty street railways in the country, including some of the largest and best known roads. Users of the stove are writing very complimentary letters to General Manager Meyers because in its use there is no cutting of seats, and no complaint against the stove from occupying too much space or lack of heating qualities. Altogether the stove seems to have met decided success.

Cushing & Morse, 225 Dearborn St., Chicago, have succeeded to the business of Mr. F. W. Cushing, the well known and popular western agent for Day's Kerite wires and cables, who has been compelled to resign to attend to other business matters, which have assumed such magnitude that he found it impossible to attend to both. The new firm is a copartnership made up of his brother, Mr. Horace A. Cushing and Mr. S. F. B. Morse, formerly a traveling salesman in his employ. The same successful business policy of the agency under its new management will be carried out.

The Massachusetts Chemical Company, 8 Oliver St., Boston, Mass, is in receipt of letters referring in high terms to its Insullac. The Consolidated Street Railway Company, Grand Rapids, Mich., finds it "cheaper and better for insulating purposes than shellac" in armature winding. The West End road, of Boston, uses it exclusively on its generators and car motors, finding it superior to shellac, and at the same time a saving in first cost. The W. S. Hill Electric Company, Boston, finds it particularly adapted to fine work that requires good insulation. The trade in this compound has increased enormously of late.

The Reliance Gauge Company of Cleveland, O., has recently received some large orders for Reliance safety water columns, among others eight to the Standard Oil Company, Bayonne, N.J.; six to the United States Treasury building, Washington, D.C.; seventeen to the World's Columbian Exposition, Chicago; thirteen to the Wamsutta Mills, New Bedford, Mass ; fifteen to the Globe Yarn Mills, Fall River, Mass.; twelve to the Clyde Bleachery and Print Works, Riverpoint, R. I.; eighteen to the Riverside Worsted Mills, Providence R. I.; and twenty-two to the Whittenton Manufacturing Company, Taunton, Mass.

Angier & Kennard is the style of a new firm in Chicago with offices at 519 Monadnock block. The new partnership will act as selling agents for electrical, mill and railway supplies and represents the Butler Hard Rubber Company, New York Rubber Company and F. H. Lovell & Company, all New York concerns whose standing and reputation are well known to the trade. The gentlemen composing the firm are Mr. Edward Angier and Mr. Frank B. Kennard, young business men formerly of Boston, who have beyond question the qualifications as well as the capital necessary to the successful prosecution of the enterprise.

Taylor, Goodhue & Ames, Monadnock building, Chicago, close the first three months of their existence with the ending of the year, and have already made sales to electric light plants and electric roads in Maine and California, and in almost all intervening cities. On account of contracts for the entire output of certain factories, and for exclusive territory of certain specialties of merit, this firm considers itself as first hands for almost all electrical material required by electric lighting plants and electric roads. Some of the lines controlled by this firm are as follows: Columbia incandescent lamp; the Nutting arc lamp for arc and incandescent circuits; the Burton Electric Company's output, including the Burton Electric car heaters; the Wagner electric motors for incandescent, power and arc circuits; the Diamond transformer—at present new to central station men, but possessing merit that will rapidly bring it to the front; agency for a first-class carbon for arc lamps, also for one of the largest copper rolling mills in the country, and the Twin City trolley. In addition to these might be added a long list of smaller specialties.

The Standard Electric Company, Chicago, filled several orders last month, some of them being the following: Ten machines of the order of fifty, to Cincinnati; a 50 light plant at Missouri Valley, Ia.; a 50-light plant at Malta, O.; a 30-light plant at Oakland City, Ind.; a 30-light plant for A. J. Sweeney & Sons' new factory at Harvey, Ill.; a 20-light plant at Monticello, Ia.; a 50-light plant for the National Malleable Castings Company, Chicago; a third order for a 50-light dynamo for the Northwestern Electric Light & Power Company, Chicago, and a third order for a 50-light plant from the National Tube Works, McKeesport, Pa.

The Consolidated Electric Manufacturing Company, Boston, Mass., has closed a year of business, the volume of which has been very gratifying to the directors and stockholders of the company. Since Mr. Charles E. Bibber took the general managership of this company the business has been greatly extended, and such success had been attained, that there was surprise last month when it was reported that Mr. Bibber had resigned to connect himself with another company. This statement we are pleased to learn was a mistake, Mr. Bibber still being general manager. It was Mr. T. H. Bibber, a former traveling salesman, who made the change.

Waterhouse Brothers, Hartford, Conn., makers of the well-known Waterhouse arc lamp for arc and incandescent circuits, have established several agencies in order to supply their customers and to facilitate business, have associated J. N. Gamble with themselves and changed the firm name to Waterhouse, Gamble & Company. The new company is now filling many orders for its lamps for railway circuits, and is receiving flattering reports as to the efficiency of the lamps. Lamps for special purposes, of all sizes and forms, ornamental or otherwise, are also made, and a fifteen-hour lamp using a single five-eighth inch carbon is proving very popular.

A. H. Atwood, a former well known manufacturer in the east, has just established a fine manufacturing plant in Chicago where he will make carriage lamps and electrical specialties. He will make the manufacture of arc lamps, however, his leading specialty and is nearly ready to put on the market a lamp for alternating circuits, which will embrace new features and will undoubtedly prove successful for this service. He will also bring out a new direct current arc lamp which will embody new principles and be very simple in construction. The factory which has ample facilities for turning out a large amount of work is located at 166-174 S. Clinton St.

The Enterprise Electric Company, 306 Dearborn St , Chicago, reports a large increase in sales of the National India Rubber covered wire since it moved into its new and enlarged quarters. Other supplies too have been in great demand, so that the company is already more than well repaid for its change of location. A new flush switch which the company is just putting on the market, and for which it has secured the exclusive agency, is proving very popular because of the simplicity and compactness of its construction. The St. Louis branch of the Enterprise company, of which Mr. W. H. Ferris is manager, also reports a very encouraging volume of business.

L. K. Comstock, Monadnock building, Chicago, consulting electrical engineer of the new Columbus Memorial building, Chicago, is installing an interesting electrical plant in this building. Considerably over 100,000 feet of Okonite wire will be used in the wiring, and Interior Conduit will be used throughout. The electric plant will comprise two 1,000-light and one 750-light dynamos, and a storage battery of considerable size will be installed as auxiliary to the dynamos. As a precaution in case of accident, connection will be made with the Edison street mains. On the tower at the corner of the building will be a 20,000-candle power search light, and throughout the building a number of arc lights will be used on the incandescent circuits.

The Washburn & Moen Manufacturing Company, Worcester, Mass., sends us a board upon which has been tested a sample of this company's "Salamander" wire in connection with three of the leading wires on the market. These wires were tested after the manner of similar tests already reported in these columns. They were subjected to a 150-ampere current for two minutes The three samples were completely burned out by this current, while the "Salamander" was in no way affected. To test the insulation of the "Salamander," the sample was tied in a knot, yet was in no way injured by it. Tests made of this wire, both in this country and Europe, show a water resistance of over 5,000 meghoms after being submerged in salt water from six to ten days.

The F. P. Little Electrical Construction and Supply Company, Buffalo, N. Y., has been organized with a capital stock of $100.000. This company succeeds the old partnership of F. P. Little & Company, which has become so well known in the electrical field. Heretofore attention has been given only to engineering and contracting, but such a volume of business is at hand that a reorganization on a larger scale has become a necessity. Lease has been taken of a building at 135 Seneca St., three doors from the former location, and the business will be divided into two departments, the engineering and contracting department, and the supply department. In the line of supplies both a wholesale and retail business will be done. The officers of the new company are: John L. Williams president, Peter P. Miller treasurer, and F. P. Little secretary and general manager.

ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. February, 1893. NEW YORK. No. 2.

THE TRANSFORMER.

A high tension alternating current requires less copper to transmit than does a low tension current, consequently from an economic standpoint it is more desirable to transmit such a current than one of low tension. But in utilizing the alternating current for lighting purposes the low tension is the one used at the lamps on account of its greater safety and also for economic and electrical reasons. The high tension current can be transmitted long distances with comparatively small loss, and it is readily changed from high tension to low tension by means of what is called a transformer.

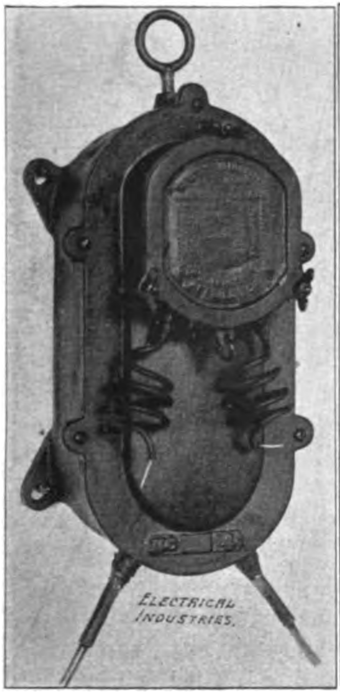


FIG. 1.

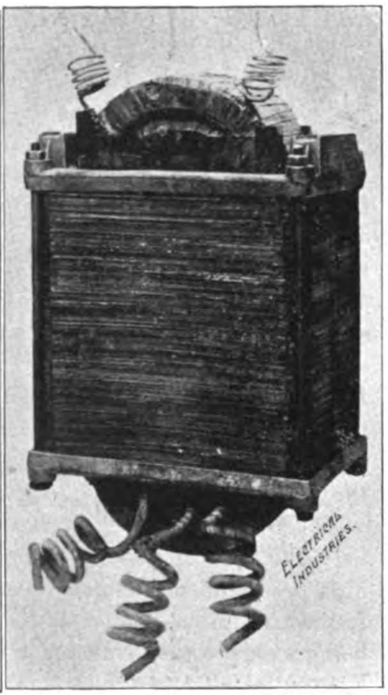


FIG. 2.

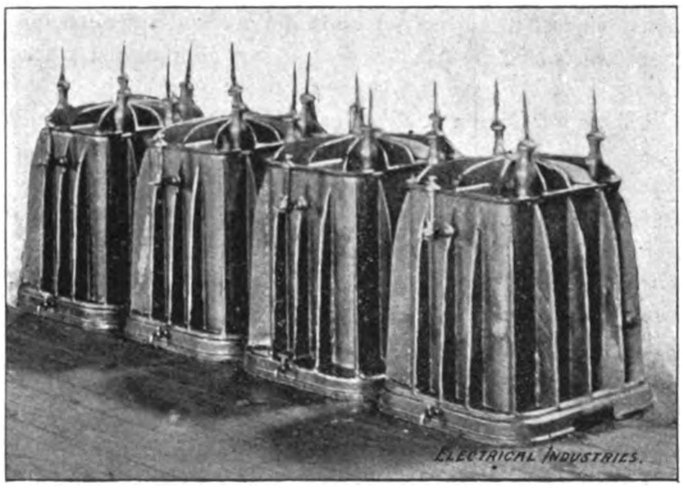


FIG. 3.

THE WESTINGHOUSE TRANSFORMER

The transformer, or as it is sometimes called, the converter, when made for reducing a high tension to a low tension current is termed a step-down transformer, and when for raising a low tension to a high tension current especially where long transmissions are desired is termed a step-up transformer. The alternating current would be of little practical value with our present knowledge of it were it not for these devices. In general use step-up transformers are rare, as a high tension current as generated suffices for most transmissions and is reduced near where it is used. Thus in the incandescent lighting plant at the World's Columbian Exposition a high tension current of 2,000 volts is generated and transmitted to the various parts of the grounds, then reduced to 100 volts outside the buildings in which it is used by transformers.

The origin of the transformer dates back to Faraday, who discovered the principles of a closed magnetic circuit by using what is termed an "induction coil." This term is still occasionally used when referring to transformers as the general principle as discovered by Faraday is still employed in every transformer on the market.

From these early discoveries practically no improvement was made until within the last decade when the alternating current came to be more popular with the increase of incandescent lighting. As this current became more used the demand correspondingly increased for improved means of changing from one tension to the other. Among the leading inventors in this field were Gaulard and Gibbs, Stanley, Ferranti, and Dick and Kennedy. The earlier machines were lacking in efficiency, liable to burn-outs, also costly, and were perhaps unnecessarily large in size.

The general principle of the transformer depends upon two coils, a primary and a secondary. If wire of the same length, and the same number of turns were used in both coils, the induced current would resemble the inducing current both in pressure—volts and strength—amperes. If the secondary wire is finer and is given more turns than the primary wire the strength of the current is reduced and the pressure increased. On the other hand if the secondary wire has fewer turns the voltage is reduced and the amperage increased. It is this latter condition that usually exists and which is found in the step-down transformer.

The usual pressure of the alternating current in American practice is 1,000 volts. But there is a growing tendency toward 2,000 volts, and in a few cases 2,500 and even 5,000 volts have been used; but the higher the voltage the more difficult the problem of insulation becomes. Suppose we have a current of 2,000 volts and 10 amperes which we wish to reduce to 100 volts. To accomplish this the number of turns in the primary would be twenty times those of the secondary, transforming the 10 amperes into 200 amperes, and reducing the 2,000 volts to 100. The ratio between the winding of the primary and the secondary in a general condition is,—the shorter the wire in the secondary and the smaller its number of turns, the greater the difference in potential.

If the pressure on the secondary becomes too great by short circuit or otherwise, there is liable to be a burn-out in some weak point which may be in the secondary or perhaps in the primary. In order to protect the transformer to as great a degree as possible from such mishaps, fuses are used, and should an overload occur the fuse "blows" and the circuit is broken. The lights on this transformer are put out but no further damage is done.

The question of insulation is a very important one in the construction of the transformer, and a variety of substances are used for this purpose, such as porcelain, mica, oil and air. Another important point in construction is the use of metal of the proper quality because of the magnetic influences. Cast iron offers such serious objections as to be almost prohibited from use, but with soft rolled charcoal iron, wrought iron, and very soft rolled steel high efficiency may be attained, and for this reason are much used. Leakage and loss incident to the transfer of energy from the primary to the secondary are difficulties to contend against. Hysteresis is another difficulty to contend against. In order to prevent these losses as much as possible, the core is built up of thin sheets of metal, each sheet insulated from the other.

During the past two or three years a number of new transformers have been put upon the market, and such improvements have been made that a good commercial transformer of today having a capacity of 100 lights or more will show an efficiency of at least 95 per cent under full load. The larger the transformer and the more fully it is loaded the higher the efficiency. It is not a rare case that a transformer is supposed to be inefficient when the trouble lies mainly in the wiring which has not been done with proper regard to requirements. In order to have a transformer work to its best advantage it is necessary that the wiring shall have been done with proper regard to the current used.

Below are illustrated and described the leading transformers now on the market. It will be observed that there are many of them, but that in the case of each care has been taken to secure as near as possible all the requirements in a good transformer.

Fig. 1 shows the form of the transformer manufactured by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The coils used in this transformer are wound upon a lathe and in addition to being insulated layer by layer as the wire is taken from the reel, there is a final insulation of especially prepared tape wound in a direction perpendicular to the length of the wire. The coils are then placed in their proper relation to each other and each coil is mounted with corner strips. The point for building up with iron is now reached. This iron is in the form of very thin sheets which are punched in suitable form for surrounding the two parallel limbs of the coils. After these sheets are placed in position iron clamps are secured at the ends and these are held together by bolts and the transformer takes the general form as shown in Fig. 2. It is then ready for mounting in the cast iron case as shown in Fig. 1. The fusing device is protected by the front plate and is easily reached by loosening the three screws as shown. The plate is attached by a chain so cannot be dropped. Immediately beneath this plate is the porcelain fuse block. When this block is removed the transformer is out of circuit and fuses can be removed or replaced as desired. Special attention has been given to minimizing the iron loss and a grade of American iron has now been adopted which is especially made and annealed for this use and the oxide which covers the plates makes the use of paper insulation unnecessary. By this construction the high efficiency and quality of the transformer is maintained and at the same time a marked reduction in cost is secured. Particular attention has been given to the construction of transformers for long distance transmission of high tension currents. Fig. 3 shows transformers for this purpose which are intended for raising the dynamo pressure, of 1,000 volts to 10,000 volts. Several transformers of this style are already in use in stations where long distance transmission is necessary. Similar transformers are used at the other end of the line for reducing the high pressure to 1,000 volts for general service. The coils in these transformers are thoroughly insulated by oil and are designed to stand a test of twice the electro-motive force at which they are used.

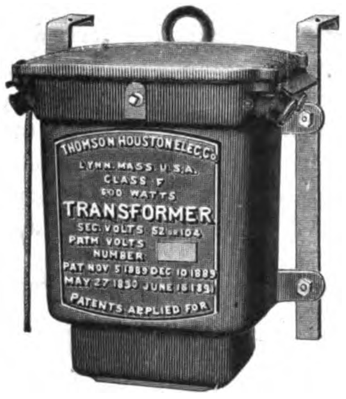


FIG. 4—SMALL TRANSFORMER OF GENERAL ELECTRIC CO.

The General Electric Company of New York, manufactures the type of transformer herewith illustrated. A high grade of mechanical insulation is obtained by the free use of mica, shellac and other materials, the purpose being to make each transformer so that it shall withstand a potential of 5,000 volts. The case is filled with oil so that both the coils and core are entirely immersed. The use of a core ground wire serves as a protection to the secondary wires of the system, against lightning or other overload. No fuses are used in the transformer case so there is no need of opening it, but fuses are placed in a separate iron box together with the primary switch controlling the transformer. Thus the transformer can be installed in any position, while the switch and fuse box can be placed within easy reach. This case is made of non-combustible material and is waterproof. The fuse terminals and the switch are mounted on a porcelain base. The primary coils of the transtormers are so arranged that the inner layers, or the points where the wire comes closest to the iron core, becomes the center of the winding, and the differences of potential between the iron core and these two inner layers can be only one-half the potential of the primary circuit. Fig. 4 shows the transformer adapted to ordinary lighting plants while the larger size of transformer particularly designed to be used in connection with long distance transmissions is shown in Fig. 5. The winding in this size is subdivided into several coils. In

15,000 watt, size both the secondary and primary are wound in two parts, while in the 30,000 wat., the primary winding consists of three, and the secondary of four separate coils. By this method of winding the highest insulation is secured. The iron coils are so constructed as to allow a free circulation of the insulating oil about the several coils. No connecting boards are used with these transformers, the terminal wires are simply brought out at the top of the case and are intended to be connected directly to the primary end secondary wires. This size is tested to withstand a 10,000 volt current, and can be used for either "step-up" or "step-down" transformers by using the secondary for the primary when used for raising the current.

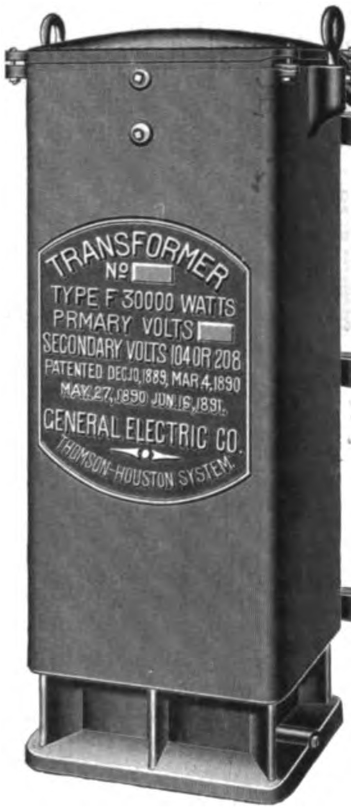


FIG. 5—LARGE TRANSFORMER OF GENERAL ELECTRIC CO.

Fig. 7 shows the core of the larger type of transformer made by the Brush Electric Company, Cleveland, O., while Fig. 6 shows the transformer complete in a weather proof case. The core as illustrated consists of a polygon ring made of Norway iron wire, each layer insulated, and so wound as to leave air spaces. Upon each side of this core is wound a single layer of heavy copper wire. The four or five single layer coils carried by each half of the core are joined in series and the two groups borne by the two halves of the core are joined in multiple, the whole constituting the secondary coil. Insulation pads are placed at the corners of the core between the core and the secondary coil. Between these insulating corner pieces are insulating air spaces, thus the copper and iron are separated from each other at the corners and at the same time ample ventilation and facility for examination is afforded. Over each of these single layer parts of the secondary coil are wound a few layers of smaller copper wire to form a corresponding part of the primary. The corresponding parts are separated by insulating pads and intervening air spaces. The insulation resistance in this transformer is exceedingly high and it is impossible to so overload the wire of the primary circuit as to force its current into the secondary; or to put it in other words, the high tension current cannot pass the converter. Safety fuses are used for the primary coils. These fuses are extra long and so mounted on slate or porcelain that they may be removed or replaced without any difficulty or delay.

The Stanley Electric Manufacturing Company, Pittsfield, Mass., has just perfected and is now ready to put on the market the transformer illustrated in Figs. 8 and 9.

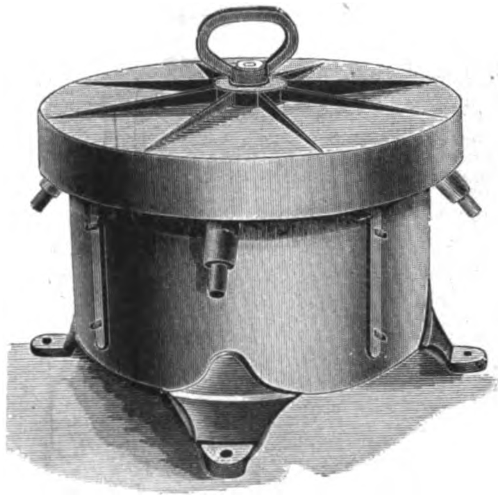


FIG. 6—THE BRUSH TRANSFORMER.

The transformer shown in Fig. 8 is of 125 lights capacity, while Fig. 9 shows the details of the fuse box. An entirely new method of insulation is used in this transformer which is believed to possess very superior qualities. The result of this new method is that the coils form a perfectly solid mass, the wires being imbedded in and surrounded by a substance of very high insulating properties. A cross section of a coil has the appearance of a section of submarine cable. This coil is moisture proof. The primary and the secondary form a solid mass and are protected from any possible contact with the iron core by a new method. In the arrangement of fuses, it is only the primary that is fused. The fuse is double pole, each wire or link being carried on a separate porcelain plug or block. To replace a fuse the door is simply dropped down by loosening one thumb screw, the plug pulled out, and an extra one inserted or a new fuse wire attached. The same size of plug is used in all sizes of transformers and there are no rights and lefts. The fuse box is entirely

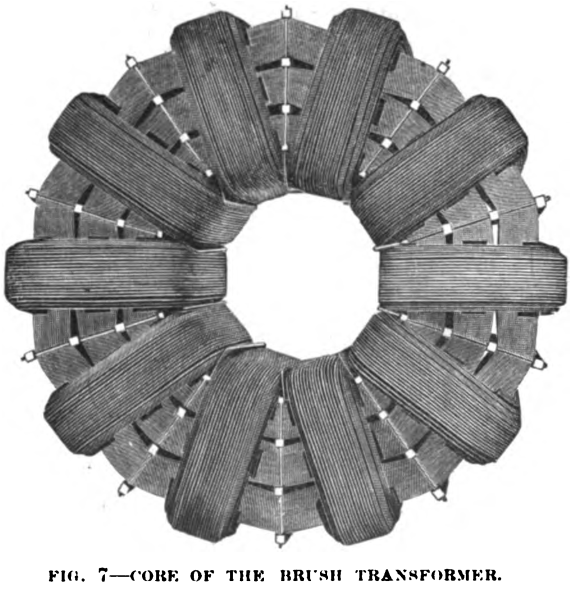
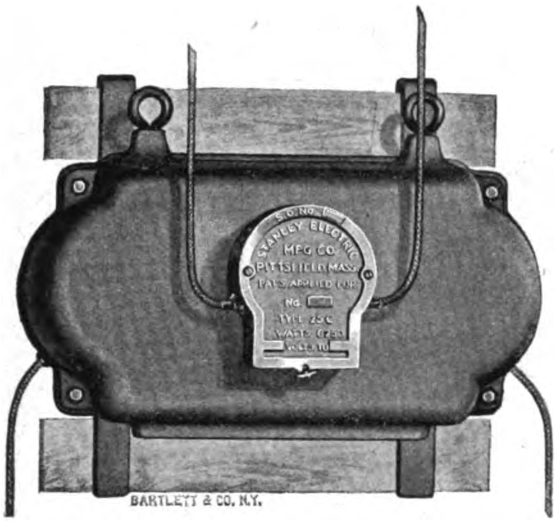


FIG. 7—CORE OF THE BRUSH TRANSFORMER.

of porcelain, and the two fuses are entirely separated from each other by a porcelain partition. These transformers are made of any capacity.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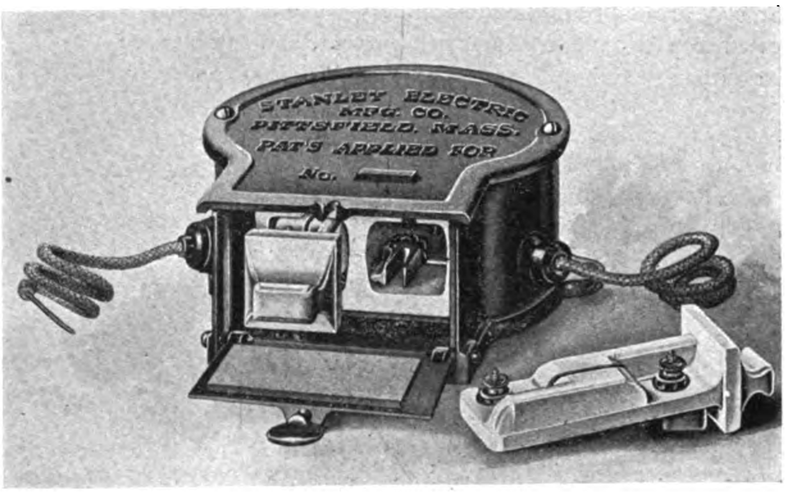
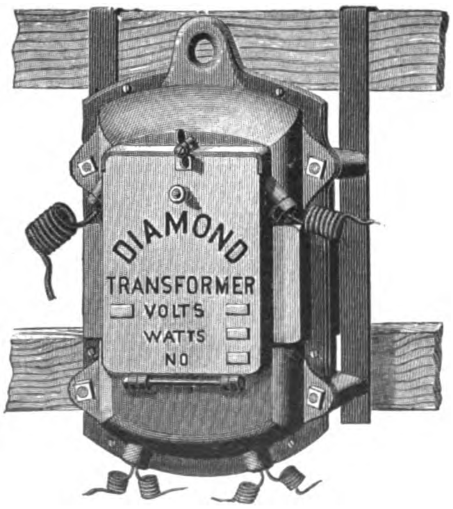

STANLEY ELECTRIC MFG. CO. PITTSFIELD, MASS. PAT'S APPLIED FOR
No.

FIG. 8. THE STANLEY TRANSFORMER. FIG. 9.

The Diamond transformer is sold by Taylor, Goodhue & Ames, Chicago. Fig. 10 shows it in position, ready for service, while Fig. 11 shows the fuse box open and the arrangement of the fuse. In this transformer, mica, porcelain and asbestos are used for insulation, thus adapting it for use on systems of high potential current, and a large amount of iron is used in the secondaries, so that it shall be correspondingly adaptable for systems of low alternations. A low induction has been adopted, so as to secure the highest average efficiency from no load to full load, and the magnetic leakage and ohmic resistance of the copper wire in the primary and secondary coils have been so controlled as to secure the most efficient regulation. The fuse box and fuse plugs are made entirely of porcelain. By simply opening the door of the fuse box, the fuse plugs are disconnected from the live wire, and the fuses can be replaced with perfect safety. These plugs may be taken out and new ones inserted in an instant without the aid of tools, and all fuse blocks are interchangeable for different sizes of transformers. To make it impossible for the blowing of one fuse to affect the other by heat, each fuse is placed in a separate compartment. The use of separable coils is an important feature of this transformer. The coils are wound on a frame ready for immediate use, and are readily inserted in place. These transformers are readily convertible, from 50 to 100 volts, on the secondary, by means of the two wires at each terminal. This transformer is easily adjusted and held in position by hooks engaging with the cross arms, while a ring in the top makes it convenient to hoist into position. Apertures are provided, both at the top and bottom, so that there may be free circulation of air through the interior, thus materially aiding in keeping the coils cool. These apertures are so arranged as to make it impossible for sleet or rain to enter the case.



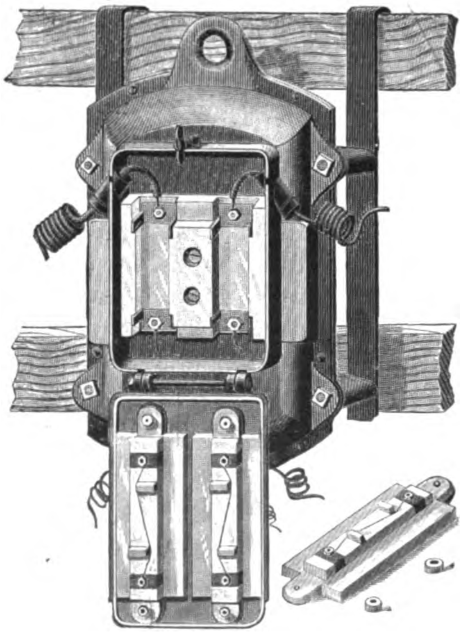


FIG. 10. THE DIAMOND TRANSFORMER. FIG. 11.

The Elkhart transformer, manufactured by the Electric Construction Company, Elkhart, Ind., is shown in Fig. 12. This transformer has shown regulation that is very high, and, in continued use, the pressure of the secondary circuit undergoes but little change from full load to no load, the E. M. F. of the secondary being practically constant. The magnetic leakage is very small, particularly in the larger sizes of transformers. The arrangement of the fusing devices is such that the primary fuses can be replaced with perfect safety. They are arranged with a porcelain cap, and in case a fuse "blows" the cap may be quickly and safely removed, and another fuse inserted in its place. In the mechanical arrangement of this transformer a permanent wrought iron hook is placed on the pole or building, and any sized transformer may be suspended from this hook, as it is designed to hold any weight. This arrangement makes it possible to change or replace a transformer in a few minutes, there being no bolts or lag screws to remove. It is simply necessary to remove the wires from the binding posts on one transformer and secure them to the other. This transformer is light in weight, but no sacrifice of more important points has been made to secure extra lightness. Low induction iron and plenty of it is used in construction, and tests have shown that this transformer runs with much less rise in temperature in the iron than is frequently the case. The coil remains practically cold, as the insulation is very high. These converters are made in all sizes.

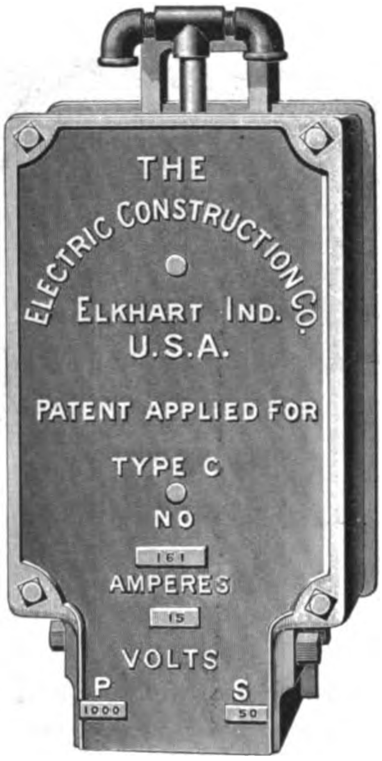


FIG. 12—THE ELKHART TRANSFORMER.

The transformer shown in Fig. 13 is manufactured by A. S. Aloe & Company, St. Louis, Mo., and is particularly designed for small work. The instrument is only 7x7x3 inches in size, and is mounted on a polished slate base. The capacity of this transformer is 240 watts. The primary is wound for either 104 or 52 volts, while the secondary is adjustable from one volt up to 8 volts, in steps of one-half a volt each. The secondary has a current capacity of 30 amperes on all of the steps. Heavy binding posts are provided for both the primary and secondary terminals. Adjustment is effected by means of a heavy special switch making contact with studs embedded in the slate base. There is also an auxiliary switch to open the primary circuit when the instrument is not in use. The leakage current of the primary on 104 volts is .6 of an ampere, and on 52 volts .3 of an ampere. This transformer is particularly designed for cautery purposes and for illuminating miniature incandescent lamps, which require an average current of not less than four nor more than five volts.

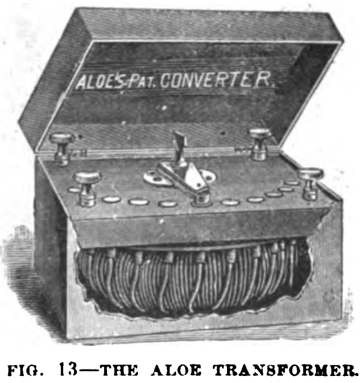

ALOE'S PAT. CONVERTER.

FIG. 13—THE ALOE TRANSFORMER.

The transformer of the Siemens & Halske Electric Company has a general appearance as shown in Fig. 14. It is made in two parts which are bolted together to form the magnetic circuit. Each half of the iron core is built up of thin laminations stamped from soft sheet iron, and insulated from each other with paper. The ends of each part are finished to a true surface and the two are bolted together by means of heavy castings fitted on each end. These cores are carefully wrapped with insulation and the low tension coil is wound on them in a lathe. The high tension coil is divided into a number of sections wound on frames of press-board and hard rubber, and slipped over the low tension winding, each coil being thoroughly insulated from each other and also from the low tension winding. The winding of the high tension coils in sections insures against the whole coil being destroyed by a burn-out, and also by this arrangement the potential of the secondary can be varied within certain limits. The transformer shown in the cut is one specially designed for laboratory work, cable testing, etc. The primary is divided into more sections than the regular commercial transformer which this company manufactures, and it is so designed that the potential in the secondary can be adjusted from 1,000 to 20,000 volts. This company makes transformers with two kinds of insulation. For general usage rubber insulation is employed throughout and this rubber is wrapped in two or three layers between the primary and secondary coils. For very high voltages oil insulation is used. The transformer is constructed in the same manner as the other type except that a free space is left between the primary and secondary, and the whole is placed inside an iron box through which only the terminals of the coils are brought out for connection. The box is closed and filled with oil of a special quality. The fuses

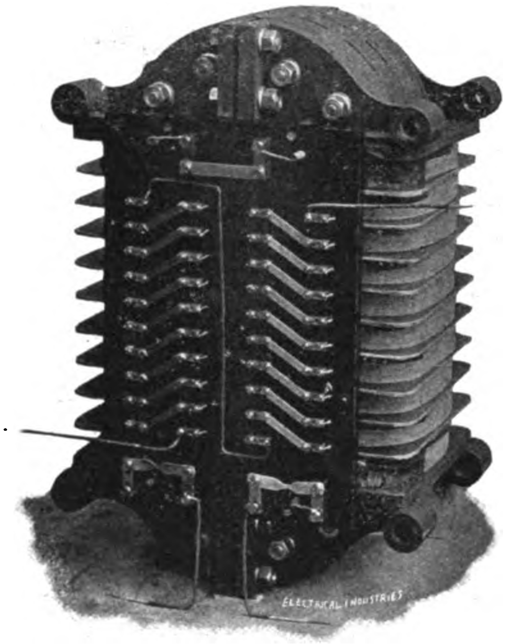


FIG. 14—THE SIEMENS & HALSKE TRANSFORMER.

for the primary and secondary are placed on a terminal board as shown in the cut. The commercial transformer with rubber insulation is provided with an ornamental perforated sheet-iron cover.

The National Electric Manufacturing Company, Eau Claire, Wis., manufactures the National transformer shown in Fig. 15. The translating device proper is enclosed in an iron weatherproof case. The novel construction, surrounding the induction coils with laminated plates of iron in a circular or radial form, renders all wires used in the coils electrically active. High results in efficiency of transformation and automatic regulation are secured by this construction. The safety device used in connection with this transformer precludes any possibility of injury or damage from contact with the primary high tension circuit. Opening the fuse box automatically breaks the connection between the wire and fuse contacts, and fuses are readily inserted without risk of shock or short circuit. The transformer illustrated is one of thirty-light capacity and with the circuit broken by making use of the safety device shown in Fig. 16.

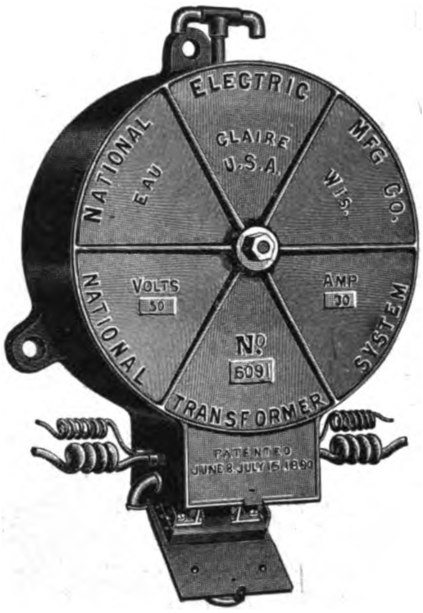


FIG. 15.

THE NATIONAL TRANSFORMER.

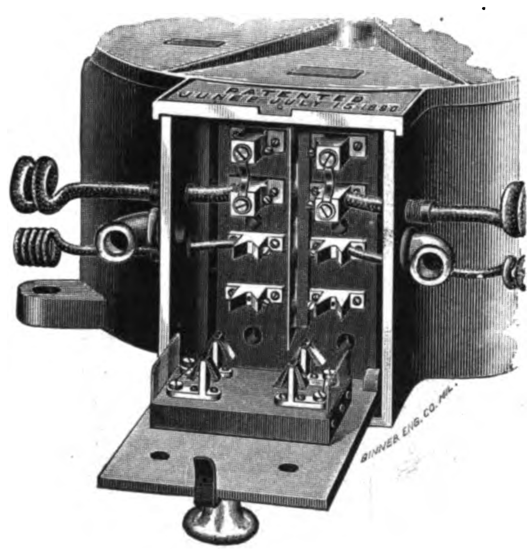


FIG. 16.

Figs. 17 and 18 illustrate the transformer manufactured by the Germania Electric Company, Boston, Mass. In this transformer particular attention is given to insulation and porcelain and other insulation of high quality is extensively used. The principal feature of this transformer is the porcelain moveable fuse plug, thus making the handling of the transformer free from danger of shock. This transformer is made as light in weight as is permissible with high efficiency. From its circular form extra compactness is secured.

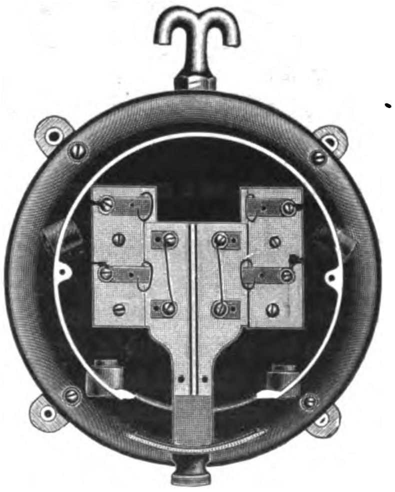


FIG. 17.

THE GERMANIA TRANSFORMER.

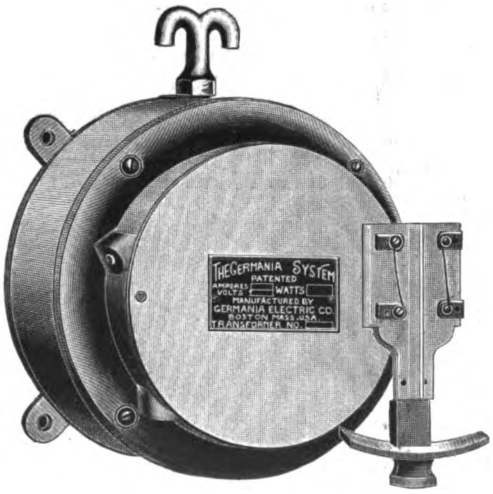


FIG. 18.

The transformer used in connection with the Slattery induction system of the Ft. Wayne Electric Company, Ft. Wayne, Ind., is illustrated in Fig. 19. This transformer is constructed on the usual principle, the core being built up and around the coils by thin sheets of soft iron. The coils are wrapped with insulating material and saturated with a fluid material of high insulating properties and further separated each from the other and from the iron core by strips of insulating fiber and mica so that very high insulation is secured. The transformer is made weather proof by an iron case and is made in various sizes and adapted to all purposes for which transformers are used.

A GREAT deal has been said about the early expiration of one of the foundation patents of the Bell telephone making this useful instrument in part public property. This expiration has been well anticipated by a number of new telephones which are ready to come into use the day the patent expires, and which will, undoubtedly, meet with large demand. But statistics for the month ending

January 20, show that the Bell telephone is as popular as ever, as the output for that month, a year ago, was 5,633, against 7,128 for this year. Deducting the number of instruments returned, the gain for this one month was 828.

THE suspense in Philadelphia as to whether or not the overhead trolley will be permitted inside the city limits is over. The Supreme Court has handed down a decision giving the Traction company complete victory. Just how much work will be done this year in equipping old lines electrically cannot as yet be decided but the franchises recently granted by the city government, and which this Supreme Court decision makes valid, carry the right to build on a large number of streets, and it is probable that at least $5,000,000 will be spent in equipping these roads this year. This will call for an immense amount of material and equipment, and it is reported that probably 1,000 new cars will be required. An important feature of the work already laid out is that about 4,000 car horses will be taken from the streets.

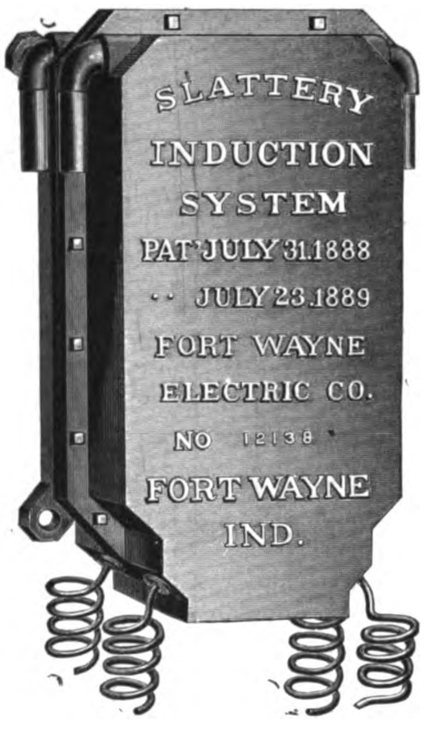


FIG. 19—THE FT. WAYNE TRANSFORMER.

COMPLAINT comes from Boston, the center of the copper interests of the country, because the dividends paid on these stocks last season, were not large enough. During the past year some of the companies added extensively to their facilities, particularly companies producing electrolytic copper. The average price of copper during the year was 11.53 cents per pound, against 12.50 cents in 1891, and 15.50 cents in 1890. The indications for the present year are for a large output of copper with close profits, a satisfactory condition to electrical interests.

THE CAPITAL stock of a corporation invested in patent rights cannot be taxed by the state, says the supreme court of Pennsylvania, because such taxation would interfere with a right granted by congress. This decision was rendered in a case of the commonwealth against the Westinghouse Electric & Manufacturing Company, and is of much importance in electrical interests in which patents are of so much consequence. There is scarcely a manufacturing corporation in the electrical field to which this decision will not directly apply, and to many of the larger companies it would make a material difference in their tax account were it to be applied.

Transportation and the National Electric Light Convention.

The various passenger associations have granted an excursion rate of a-fare-and-a-third to delegates attending the convention of the National Electric Light Association, to be held in St. Louis, February 28, March 1 and 2. To secure this rate it will be absolutely necessary for persons purchasing tickets to state to the agent from whom the purchase is made that they contemplate attending said meeting, and to procure from said agent a certificate which, immediately upon arrival in St. Louis, should be left in the secretary's office, addressed to the undersigned, who will see that it is properly vised and returned to the owner.

Arrangements are being made for a special train from New York to St. Louis, which will exceed in the way of equipment and appointments anything that has ever been in service between these two points. To bring this matter to a successful issue, it is very important that the number of passengers who wish to avail themselves of this train should be known at the earliest possible moment. Therefore, it is very desirable, and will facilitate transportation matters greatly, if all delegates who contemplate using this train will make application for space at once.

C. O. BAKER, JR.,
Master of Transportation.

136 Liberty street, New York.

The matter of rates is at present under consideration by the Western Traffic Association and will undoubtedly result in the securing of the same rate. Mr. J. Scribner, 173 Adams St., has been appointed by Mr. C. O. Baker, Jr., Master of Transportation, to take charge of transportation matters for Chicago and to him communications may be sent with reference to accommodations for those who go from Chicago.

The St. Louis Electric Club has appointed committees to have charge of the arrangements for receiving the National Electric Light Association and these committees are made up as follows:

Mr. J. A. J. Shultz was appointed chairman of the Finance Committee, and with him are associated James I. Ayer, E. D. W. Meier, George P. Jones, T. M. Ambler, Louis Nahm, C. R. Scudder, Robert B. Annan, Marcus Bernheimer, John S. Moffit, Frank R. O'Neill, F. J. Wade, L. D. Kingsland, Frank Shapleigh, Frank Gaiennie, Goodman King, Ben Eiseman, Douglas Cook, Ellis Wainwright, A. Siegel, S. G. Booker, John C. Wilkinson.

The Executive Committee is Mr. Nahm, chairman; James I. Ayer, Frank Gaiennie, Nathan Frank and Goodman King.

Other committees are:

Invitations for Tesla's lecture—Goodman King, W. L. B. G. Allen, Jas. I. Ayer and C. R. Scudder.

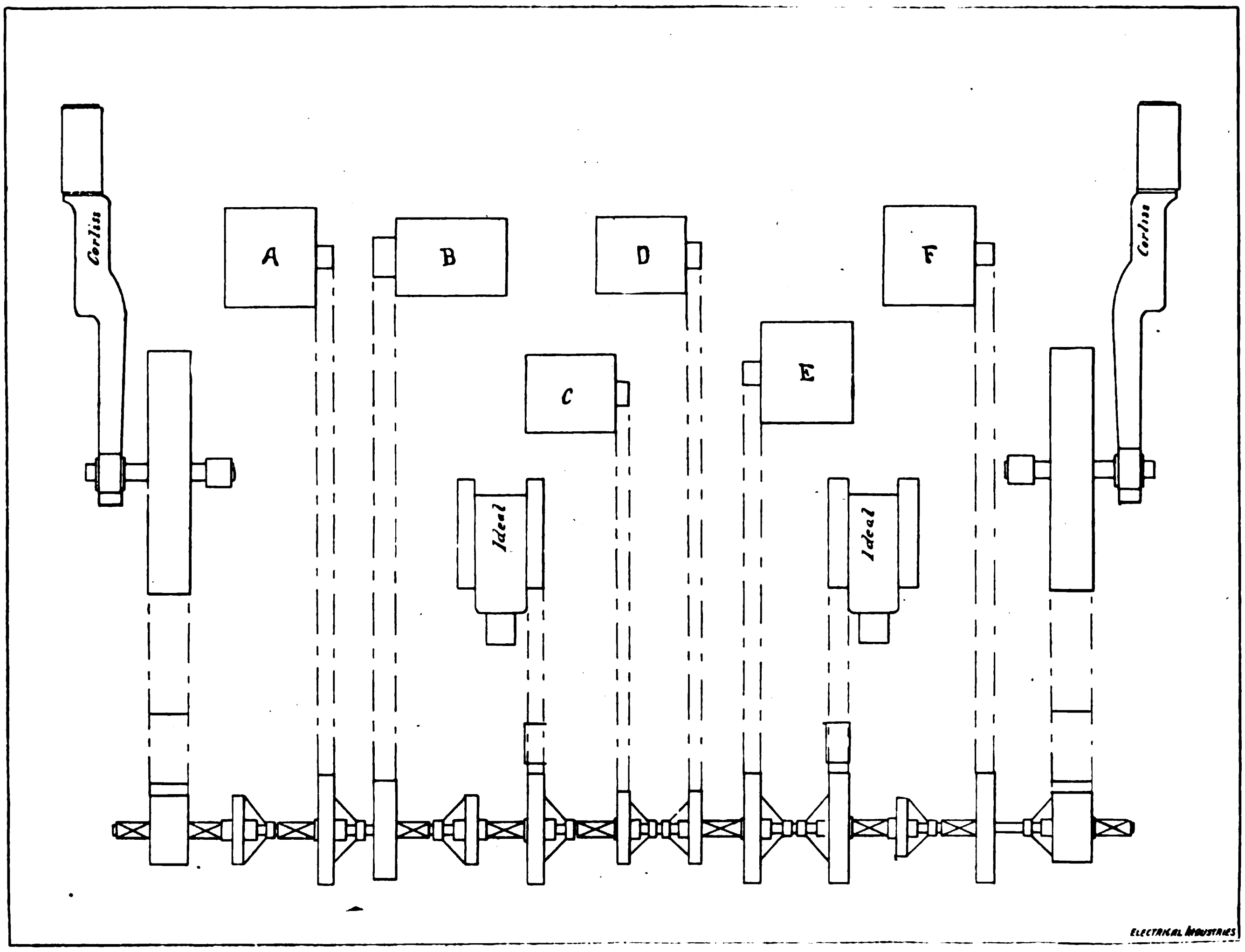
Committee on Reception for Lecture—Messrs. Ayer and Gaiennie.

Entertainment Committee—Messrs. Nathan, Frank and McCulloch.

Banquet—Messrs. Gaiennie and Nahm.

Electric Light and Railway Plant at Marshalltown, Iowa.

The Marshalltown Light, Power & Railway Company at Marshalltown, Ia., has just installed an electric plant and equipped an electric railway which contain much of interest because of their completeness of construction. The power station is a substantial building with an arrangement in the engine and dynamo room that is well worth studying. This arrangement is shown in the accompanying diagram. There are two Ideal engines, one of 80-horse power, the other of 100-horse power belted direct to the line of shafting. At one end of the shafting is a Corliss engine of 150-horse power with a twelve foot fly wheel weighing 23,000 pounds, manufactured by the St. Louis Iron & Machine Company, while at the other end of the shafting another Corliss engine will shortly be installed duplicating the one now in operation. The shafting is so arranged with friction clutches, etc., as to permit complete interchangeability of the engines and dynamos. The counter shafting and clutches and clutch pulleys were manufactured by the Falls Rivet & Machine Company. The general arrangement of the shafting is well shown in the diagram.



GROUND PLAN OF POWER PLANT, MARSHALLTOWN LIGHT, POWER & RAILWAY COMPANY.

Belted to this shafting are to be the three alternating dynamos, A of 650-lights capacity and E and F each of 1,000 lights capacity. Dynamos C and D are 50-light full arc dynamos, while B is a 125-horse power railway generator, the apparatus all being Thomson-Houston. The company proposes to run stationary motors from its trolley wire, thus furnishing electric power for manufacturing purposes besides operating a street railway and furnishing light. In the boiler room is a battery of three boilers each rated at 115-horse power. The steam piping is on the duplicate system so that should an accident occur or a defect be found anywhere in the line it would not be necessary to shut down the plant.

The street railway line of this company is three miles in length, extending from the Union station up to and through the entire length of the main street to the Soldiers' Home, with a branch from the main street to the cemetery and water works. The grades of the line are very easy, the steepest one being only about 5½ per cent. In the track construction 40-pound rails are used. They were manufactured by the Illinois Steel Company. The overhead construction is designed to be as substantial as improved methods can make it. The trolley wire is of number 0 hard drawn copper; the pole construction is of 35-foot poles from the station to a point beyond the business portion of the town, and the electric light wires are carried on brackets on the top of these poles.

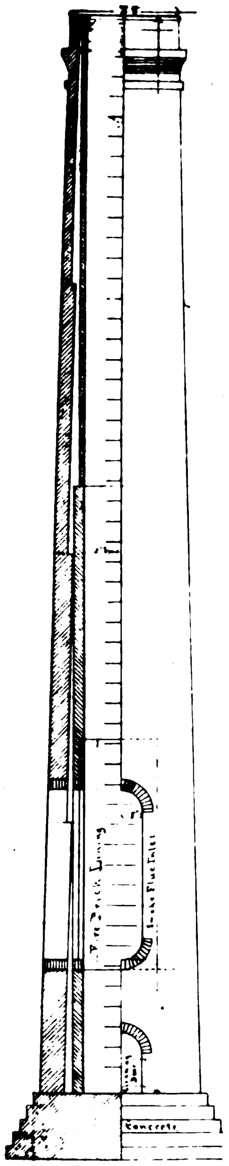
The company operates three motor cars with two Thomson-Houston equipments on each car. The cars are very attractive ones, and complete in finish and construction, being manufactured by the Pullman Palace Car Company. The type of this car is shown in the accompanying illustration. The bodies are 16 feet long, the length over all being 23 feet 4 inches. The interior finish of the cars is cherry and ash neatly paneled and highly polished, while the ceiling is decorated. The seats are of slats of ash and red birch and are covered with fine quality and richly colored Wilton plush carpeting. Each car is fitted with a

Garland heater, provided with sand boxes, and is mounted on a No. 19 F motor truck manufactured by the McGuire Manufacturing Company, Chicago, of standard gauge. On the floors of the cars is longitudinal floor matting.

1
MARSHALLTOWN L.P. & RY. Co.
ELECTRICAL INDUSTRIES

EXTERIOR VIEW OF CARS MARSHALLTOWN L. P. & RY. CO.

Each car is furnished with an oil headlight and also fitted with Stanwood steel steps. The seating capacity of the cars is twenty-two people.



PLAN OF SMOKESTACK, MARSHALLTOWN L. P. & RY. CO.

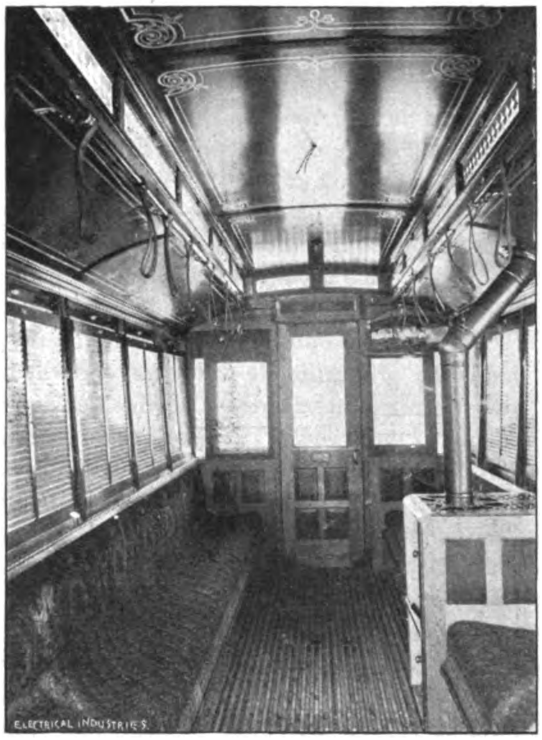
The street railway observed the appearance of the new year by going into operation. Attention will now be given to the lighting plant which will be in full operation soon.

The Thomson Recording Watt Meter.*

BY J. MCFADDEN.

In designing this meter several essentials had to be strictly observed: First, the meter must be theoretically correct in principle; second, it must be of the simplest possible construction; third, it must be easy to install and to maintain in operation; fourth it must be accurate throughout its range; fifth, it must be automatic. In addition to these requisites it was the aim of the inventor that the meter should operate with equal facility and accuracy on circuits of either direct or alternating currents, and it was his opinion that such a meter should be a motor meter; that is to say that it should be actuated by the same energy which it measured, avoiding, for instance, the necessity, as in clock meters, of winding up the mechanism at stated intervals.

Briefly, then, this meter consists of a simple skeleton motor, having no iron either in armature or field. The fields, which consist of two coils, one on either side of the armature, are connected in series with the lamps or motor, whose absorption of energy they are to measure, all the current in use passing through these field coils. The armature, which is of the Siemens drum type, is hollow, and is made of a fiber cylinder, over which the coils are wound. On the end of the shaft of the armature is a silver commutator, on which rest flexible bronze brushes, provided with silver contact pieces. The armature is shunted across the circuit in the manner of a lamp, and to cut down its current a high resistance of fine wire is connected in series with it, the whole forming a pressure coil whose current varies with the voltage of the system.



INTERIOR OF CARS, MARSHALLTOWN L. P. & RY. CO.

It will readily be seen, therefore, that as the field varies with the current, and the armature with the pressure, the speed of the motor will vary directly with the energy or watts in use, which is of course the ideal method of measurement.

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* Abstract of paper read at the meeting of the Chicago Electric Club January 16, 1893

Friction would, however, seriously affect the accuracy of those results were it not compensated for. This is accomplished by taking off the armature circuit beyond the fields. Thus there is a slight constant field, independent of that created by the current flowing to the lamps, caused by the flow of the armature current through the field coils. On very low loads, where friction is a strong factor, this "shunt" or constant field forms a comparatively considerable percentage of the total field and torque, thus nicely balancing the meter against friction, whilst on medium and high loads both friction and the shunt field become so insignificant a percentage of the total load and torque that their influence cannot be detected and may be neglected.

Another essential feature of the meter deserves description: namely, the slowing mechanism or means for loading the meter. The necessity for this retarding mechanism is too apparent to need explanation, and has been fully appreciated by all makers of recording motor meters. In the Thomson meter this is accomplished in the most simple and satisfactory manner by placing on the shaft a thin disk of copper some little distance below the armature. This disk rotates between the poles of three permanent magnets. The fields of these magnets generate Foucault or eddy currents in the disk, thus forming a considerable drag or load on the motor, which is constant and proportionate in its action. Thus it will be seen that, neglecting friction, which, as we have noted, is compensated for, the meter is proportionate throughout, for torque is directly proportionate to the product of current in armature and fields, which equals amperes x volts—that is, torque is directly proportionate to power or watts passing the meter. Speed is directly proportionate to torque, and the retarding effect or generation of current in the disk is directly proportionate to the speed. Therefore, the theory of the instrument is consistent and correct throughout.

Another good feature of the meter is that the drag or load is considerable, hence friction, which is the only varying quantity, forms, even on light loads, but a small proportion of total retarding effect.

The indications of the meter are shown in watt hours on the dial, the first wheel of whose train engages with a worm on the shaft, thus connecting it with the revolution of the armature. The five dials of the whole train will record up to 10,000,000 watt hours, that is to say, approximately 200,000 lamp hours, and it is only then that the dials all come back to zero. This for the smaller sized meters without constants. The largest sizes will register as high as 360 million watt hours before reaching zero again.

By an examination of the dial it will at once be apparent that the friction absorbed in actuating the recording mechanism is so small as to be negligible, as the power required is so slight that it is scarcely possible to move with the finger the first gear, which engages with the worm on the shaft so slowly as not to see the first dial hand move, and yet when the meter is running at full load this motion of the dial hand is not discernible. Here then is one of the two possible chances for friction, reduced to practically zero.

It is essential that a motor meter have a slow rate of revolution so that no possible resistance can be introduced by reason of friction of the gears of the train, or on the lower and only bearing. To accomplish this, and still to use the same recording mechanism on all meters, the larger size meters are made of such electrical dimensions that their rate of revolution will be 1-2, 1-3, 1-6, etc., slower than their normal, thus keeping the revolution of all meters down to about sixty revolutions per minute at full load, and consequently lengthening the life of the meter. In such cases the corresponding constants of 2, 3, 6, etc., are marked on the dial by which the readings are to be multiplied. These constants are uniform throughout any given sized meter.

The only other point in which friction might appear is at the bearing on which the lower end of the vertical armature shaft rests. This, again, is reduced practically to zero by having the shaft's point hardened, very carefully ground, and highly polished, and in having the bearing made of sapphire. This jewel is inserted in the end of a brass screw which passes through the bed plate of the meter.

It may have occurred to some that as the size of the meter increases, so would the number of turns in the field decrease, and therefore a meter of 100 lights capacity would not have the same amount of initial field due to the armature current passing through the series coils, as would a meter of small capacity. Strictly speaking, and were no provision made for it, this would be quite true, but in cases of this kind the initial torque is maintained by the insertion of what is termed the shunt field coil, wound inside of one or even in some cases of both the series field coils. In cases of this kind the current passing through the shunt field acts in unison with and in the same direction as the series fields, and then through the armature, maintaining approximately the same number of initial armature field turns and the same initial torque to counter-balance friction.

The Thomson recording watt-meter is made for lighting or power circuits of all commercial voltages, and for primary circuits of alternating current stations for measuring the total output from an alternating machine; and for measuring the output of direct current light or power stations in sizes from 10 amperes to an instrument as high as 600 amperes capacity, one meter thus being capable of measuring the output of some of the largest generators now made.

These meters are also made to record on a single dial the consumption of energy from both sides of an Edison three wire system and to measure the power consumed by an electric car to check the wastefulness of economy of the motor man; in fact they are made in about fifty-five different forms, varying in voltage, amperage and in construction, according to the uses for which they are intended.

The Massachusetts railroad commissioners in their annual report to the legislature comment on the rapid growth of electric traction in connection with street railways. For the year ending September 30, 1892 the street car mileage of the state is reported as 814 miles. Of this mileage 492 miles are operated in whole or in part by electricity; an increase in electrical mileage for one year of 203 miles. Only one road is operated by storage batteries. The commissioners are of the opinion that the time has come for the legislature to consider under what regulations the electric railway system shall, in the future exist and develop. The report also speaks of the great activity in electric railway construction, stimulated by the hope of large profits in consequence of the cheapness of this motive power over the horse railroads.

The Incandescent Lamp.*

BY R. G. BLACK.

Admirable as is the system of arc lighting for use in streets or large halls, it is entirely unfit to take the place of the numerous lights of moderate intensity employed for general domestic illumination. For this purpose it was, at a very early period, perceived that the incandescent, or heating to luminosity of a continuous conductor by an electric current, was the most promising method. It was also at an early period perceived that the conductor to be used for this purpose must be one which would admit of being raised to a very high temperature without being melted or otherwise destroyed.

The first material which was thought of in this connection was platinum, or one of its allied metals, such as iridium, which have the highest melting point among such bodies, and are beside entirely unacted upon by the air at all temperatures. In 1848 W. E. Staite took out a patent for making electric lamps of iridium, or iridium alloy, shaped into an arch or horseshoe form.

One of the most serious difficulties, however, even with these materials, was that, to secure from them an efficient light, it was necessary to bring them so near to their fusing points, that a very minute increase in the current would carry the temperature beyond this, and destroy the lamp by fusing the conductor. An escape from the difficulty was offered by the use of hard carbon, such as used in arc lamps, but here the compensating drawback was encountered, that this substance, when highly heated, was attacked by the oxygen of the air, or in other words, would burn. To meet this, plans were devised for the replacement of the consumed carbon conductor, and for its protection from the air by enclosing it in a non-active gas, or a vacuum.

Thus in 1845 a patent was taken out by Mr. J. W. Star, of Cincinnati, for an incandescent lamp, the important parts of which are a platinum wire sealed through the top of a small glass chamber constituting the upper end of a barometer tube. This platinum was clamped to a thin rod of carbon supported by a non-conductor and connected by a wire to the mercury below. By passing the current through the platinum wire and thence through the carbon to the mercury the carbon strip, or rod, would be made incandescent, and was to a certain extent protected by the surrounding vacuum. Though this lamp produced a brilliant light, it proved in various respects unsatisfactory, and was abandoned after many trials.

Other inventors, as for example Konn, of St. Petersburg, continued to work with rods or pencils of hard carbon, and achieved a limited success, but the irregularities and brittleness of the material seemed to have been an insuperable objection and drawback, and the problem of commercial electric lighting by incandescent conductors yet remained without a solution.

This was the state of affairs even up to the fall of 1878, when, as it is claimed, Mr. William E. Sawyer, in combination with Mr. Albion Man, after many preliminary experiments, produced a successsful incandescent lamp with an arch-shaped conductor made of carbonized paper. The lamp brought out by these gentlemen, after filing their application for a patent, in January 8, 1880, described and shown in that application, was a rather large and complicated structure, and had no improvements or specifications of this lamp been made the present immense development in electric lighting would no doubt have been unattained.

It is to Mr. Thomas A. Edison, without doubt, that we owe many of the simplifications and modifications which, by cheapening the lamp and diminishing its weight, have extended its range of use and its usefulness to a remarkable degree. Like many before him, he first turned his attention to platinum and platinum alloys, and devised a form of lamp admirable for its simplicity, but unfortunately open to many fatal objections. During the year 1878, however, Mr. Edison was most diligently at work, and perceiving the imperfections of his first idea, sought in every way to overcome them. Having experienced insuperable difficulties present in metallic conductors, he turned his attention to carbon in its various forms, finding fibrous textile material when carbonized to be the most convenient. Though working with the same material and form, Edison produced a structure very different in appearance from that of Sawyer and Man, but bearing a marked resemblance to the lamps of recent manufacture.

The incandescent lamp of today is made in two parts; the outer flask, or the bulb, and the inside part. The first operation on the bulb is to punch a small hole in the center of the closed end of the flask where the exhausting tube is attached. Then the neck is cut off, making the flask the proper length for the carbon. While the bulb is being thus prepared, the inside part, which supports the carbon, is being made. This is done by taking a piece of glass tube about six inches long, and holding it in a glass blower's fire until one end becomes white hot, then two copper wires ingeniously welded to short pieces of platinum wire are run up through the tube until the platinum extends about a quarter of an inch above the hot end of the tube; then the tube is again heated until the platinum and the glass come to a white heat. The end of the tube is then squeezed flat, the platinum being hermetically sealed in the glass. Platinum wire has to be used, as it is the only conductor that has the same coefficient of expansion as glass. These, after being annealed, are ready to have the carbon clamped on. This used to be done by welding a small copper clamp to the end of the platinum, the clamp and the carbon being then copper plated, making an excellent joint. This is done by a simpler process now, however. When the carbon has been securely fastened to the platinum, the inside part is ready to be sealed into the bulb.

Until recently the bulb was sealed over the inside part by hand, but within the last few years a machine has been devised to do this otherwise skillful and difficult manipulation. The bulb and inside tube are turned in the fire until they are securely sealed together. The lamps are then annealed, and after the projecting piece of the inside tube which has served as a handle, has been cut off, the lamps are ready for the vacuum pumps. The next thing to be done with the lamps is to exhaust them. For this purpose they are attached by the small glass tubes before mentioned to the phosphorus cups, and those in turn are attached to pumps and the mercury turned on. The mercury is allowed to run until a good vacuum has been secured, then the current is turned on and the carbon filaments heated to a dull red, being gradually increased until about half the rated candle power of the lamp is reached. Then each lamp has to be treated individually, in order to work out any gases or impurities in the carbon.

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*Read at the Convention of the Canadian Electrical Association, Toronto, Ont., Jan. 25th, 26th, 1893.

This is done by placing a strong magnet at the lower end of the carbon to prevent it from wilting, while the current is suddenly increased and the light raised to great brilliancy for a second or two. This is repeated several times, until the mercury tube shows that the gases have been dissipated by the extremely high temperature of the filament. The eliminating of the gases is considered the last of the many stages through which the carbons of our incandescent lamps pass. It is only necessary to seal off the connecting tube which leaves a small top on the lamp where the hole has been closed up. The lamps are then socketed and tested for the volts required to give a certain predetermined candle power. The voltage is marked on the bottom of the lamp and then it is ready for shipment.

Some of you will ask no doubt, is there not danger of destroying the filaments while driving out the gases? Well, there is, if great care is not exercised. The test is a severe one and only good filaments will stand it. However, it seems a necessary evil. The carbon filament is the all essential part of the incandescent lamp; so important is it that the manufacturers have tried almost every conceivable substance, calling on the productions of the mineral, the animal and the vegetable kingdoms.

Although many good hair filaments are made, vegetable fiber seems to be the most preferable substance for carbonization. The process, although most sacredly guarded by the different manufacturers and varying vastly in detail, is in general as follows: The substance to be carbonized, whether paper, cotton or bamboo, is cut by a machine into delicate strips which are collected in small bundles and bent so as to lie in "U" shaped grooves in graphite plates. These, packed with graphite powder, are placed in large black lead crucibles, carefully closed and heated, in a Siemens furnace to an intense white heat. After cooling the crucibles are opened and the now carbonized filaments looking like delicate wires, or threads of steel, are removed. They are now the curved shape into which they were bent before carbonization, but are quite elastic and strong. There are various after treatments, such as subjecting the carbons to a plating process, or treating in a vacuum with hydrocarbon, etc. But as said before, the different processes to which these filaments are subjected, are trade secrets. In them lie the important distinction of life and economy given by lamps of different manufacturers.

The distinctive features of the different types of incandescent lamps, which are in practical use now are naturally infinitely less striking than those in the arc lamp. The latter employs a more or less complicated regulating mechanism, and the constructive detail of this mechanism gives rise to an enormous variety of lamps. The incandescent lamp which is fortunately restricted to the use of an incandescent filament placed in an exhausted globe which does not require any regulating mechanism, allows of a difference only:

1. In the choice of the raw material from which carbon filaments are made.
2. In the treatment of the raw material before and after carbonization.
3. In the length of the filament and its cross section.
4. In the mode of connecting the filament with the current conductor, or platinum wires, respectively, which join it to the leads.
5. In the more or less perfect exhaustion of the lamp bulb. In considering these different points, we wish to arrive at a conclusion, not that one particular type of existing lamp is superior to another, but what are the conditions to be filled in order to obtain an efficient incandescent lamp of good durability.

All incandescent lamps with the exception of the Cruto and Bernstein lamps, employ a vegetable fiber of some kind as raw material for preparing the filament. Edison considers the fibrous structure of bamboo advantageous for obtaining a tough filament of high mechanical resistance; while Weston on the other hand subjects the cotton fiber to a process which entirely deprives it of its structural character and transforms it into amorphous cellulose, for which he likewise claims great toughness and mechanical resistance. We know that excellent results have been obtained with both these filaments, from which we may safely draw the conclusion that the nature of the raw material is of little consequence as long as it is of a thoroughly homogeneous character. The carbon is exposed to a series of deleterious influences, which are the more effective, the less coherent the filament, not to mention the shocks and concussions to which the lamps are subjected in transportation. We find that, according to the mechanical theory of gases, the last remnants of atmospheric air, which are, even in the most careful exhaustion, left in the lamp bulbs, are set into rapid motion by the intense heat of the carbon; and thus the latter is exposed, so to say, to a continuous bombardment, which soon finds out any weak spot in its texture and brings about a rupture of the filament. There are other influences at work tending to produce the same result, namely: The disintegrating effect of the current and the high temperature to which the filament is raised, and which show themselves in the projection of carbon particles on the interior of the lamp bulb (commonly called the blackening of the lamp bulb).

Under this head, we have also to consider a fact observed by Edison, namely: A continuous current passing through the carbon wastes it more rapidly on one side than on the other. For explanation of this fact, we must assume a sort of electrolytic process in a space which is not absolutely free from air, but only highly attenuated. If this observation is correct, and we have no reason for doubting its accuracy, it constitutes an additional reason for the importance of the uniformity of the filament. We have further to take into consideration the influence of the electric current on the structure of the carbon filament; and that such an influence is exercised has been proved by the molecular changes of a copper wire through which the currents of an alternating machine have been passed for some time. Finally, the higher the temperature to which the carbon is exposed the shorter its durability, and the more marked the deleterious effects on a filament of inferior compactness and uniformity. Hence the condition of radiating surface is one of the main factors in the economy of the glow lamp, and the whole treatment subsequent to carbonation has for its aim to endow that surface with the highest possible radiating capacity.

As the total cost of the light is increased by going to either extreme, of long life and poor efficiency on the one hand, or good efficiency with short life on the other, there must be some intermediate value for the life and efficiency which would give the most economical results, considering both the cost of the lamp and the power required. Numerous methods have from time to time been suggested and used to determine this point with more or less success. But they have apparently led one to believe that a long life is a most desirable feature, so much so, that extremely long lived lamps were considered as great achievements in lamp making. More recently the tendency has been to increase the efficiency slightly and to diminish the life. But it appears now from the very interesting deductions of Mr. O'Keenan, that the most economical point, considering all the factors involved, is very materially different from what was generally supposed, and that it is in fact cheaper to replace old lamps with new ones after a few hundred hours, than to continue to burn the old ones. He shows that there is a point in the life of each make of lamp at which it will pay best to break the lamps. To this point he gives the appropriate name of the "smashing point."

Whether we accept these statements or not, lamp renewals is an important item of the expense of an illuminating station and amounts to considerable, even in small isolated plants. It is therefore a question of momentous importance to be able to decide what kind of lamps are best to use, and what is the best way to manage them, so as to procure the most satisfactory results, not only with regard to the financial interests of the illuminating company, but also that the public may get the best value for their money.

Having decided upon the best lamp to use after giving due consideration to the various data supplied by different manufacturers, all of which should be received with the greatest of caution, the next thing to obtain is an absolutely steady current. A precisely even potential is one of the most essential requisites for obtaining any sort of satisfactory results with incandescent lamps. It is astonishing how little attention is paid to this important feature of incandescent lighting. Tests which we have made convince us that there are few stations in Canada that can boast of a potential which does not vary from five to fifteen volts either side of what it is supposed to be operated at. A raise of three volts in a 100-volt lamp will reduce the life one-half. This change is much more marked in lamps of lower voltages. It is a wonder that lamps last half as long as they do, subjected as most of them are, to such a range of potential, varying in many cases of from 100 to 125 volts. We would most emphatically recommend that a man be detailed in every large plant or station to watch the pressure indicators and regulate the current accordingly. Also that the station be provided with a good portable volt-meter, so that the potential may be known at different points. If these regulations are strictly and properly carried out, there would be far fewer complaints about incandescent lamps.

This branch of electrical industry is launching out into new channels, and even now plays an important part in the service of man, not only in domestic spheres but also in the scientific and other useful pursuits of life. Lamps can be had from a fraction up to several hundred candle-power, varying in size, shape, color and efficiency. Now that we have the Ries regulating socket by which the light can be turned up or down without waste of current, the incandescent light is in every way superior and has every advantage offered by any other illuminating agent without their disadvantages, defects and impurities.

Aron Meter.*

BY CHARLES WIRT.

I have had a little experience with the Aron meter in the laboratory, and I am much interested in it. It is familiar to most of you, and the mechanism is simple. It consists simply of two pendulum clocks, each being run by a spring, capable of running thirty days at one winding. Each clock has a pendulum of the same effective length, giving synchronous vibrations. The pendulum of the left hand clock is weighted with an ordinary brass bob. The pendulum of the right hand clock has a permanent magnet for a bob. Those two clocks are geared on the counter differentially, so that when they are running properly and in synchronism the counter stands still. Any difference in the rate of the two clocks is registered on the counter. The electrical part of the meter is merely a pair of coils. In the meter for a two-wire system there is only one coil, and the bob is single instead of double. Those coils are close underneath the permanent magnet bob, and carry the main current. The current is so put through the coil as to magnetize the permanent magnet in the same sense in which it is originally magnetized. There is no tendency to reverse or decrease the strength of the permanent magnet. The principle of operation is simply that the attraction of the coil for the magnet acts exactly as an increase of gravity and increases the rate of vibration; so the magnetic pendulum runs faster than the other, and the difference in rate is registered on the counter. That difference in rate is proportional to the current passing; and one of the advantages of this meter is that it is capable of an infinitely fine rate of registration. It does not register down to one per cent only, but it will register down to any per cent, no matter how small, of the total current.

The extremely small difference in the rate of the two pendulums on which the reading of the meter depends is rather surprising; at full load the difference in the rate is only about one-tenth of one per cent. It follows that an error in either clock work of one-tenth of one per cent would suffice to wipe out the largest record that the meter might make. The meter working at one per cent of the full load would give a variation in rate of only one part in 100,000.

When I took that meter to test it, some years ago, the first thing I wanted to find out was if the effect of the current would not be to increase the magnetism in the magnet, so as to give a rate different from the rate required theoretically. I found that the actual magnetic effect of the current was so small, and the strength of the magnets and their hardness was such, that the effect was not appreciable. The meter can be taken as strictly proportional to itself throughout its range. That makes it valuable to test other meters by; after having determined the rate of the meter, it can be depended upon for a time to agree with itself, and to give readings that are proportional to the true values.

The next thing I wanted to find out was whether a short circuit or disturbance in the main circuit would not so affect the magnets as to permanently alter their value, and so cause false reading. I tried short circuits, and did not succeed in making any permanent change in the magnet, but I did find that by reversing the current and putting it through the meter in the reverse direction, and then making a short circuit, the magnets had been permanently changed, and the constant of the meter altered.

The constant of the meter which is sent out should be redetermined for each meter before it is put into use.

The mechanical part of this meter has been very well worked out. The clock work is admirable; it is not large, having very little work to do, much less work in fact than an ordinary eight-day clock has to do in moving the hands. But the design of the case and some of the other details of the meter are rather too clumsy to suit the American taste.

I have not had any extended experience with this meter, and I do not know to a certainty whether the magnets retain their permanency over long periods of time. The meter has never come into use in this country, probably owing to the fact that we have had good meters, and that no one has seen fit to undertake the manufacture of this one here. They are largely used in Germany, and I understand with gratifying success.

I know one central station that put in an electrolytic meter, having first tested this meter and made very careful calculation as to the cost of operating both, and concluded that the cost of the Aron meter at the then ruling price would more than offset the gain in operating expense, and they put in the electrolytic meter.

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* Read at the meeting of the Chicago Electric Club, January 16, 1893.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

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It is very evident that practice in connection with the alternating current is growing toward the use of higher tension currents. In Europe 2,000 volts is the usual current, and the evident advantage of this tension over the 1,000 volt current which is the common practice in this country, is too apparent. The World's Fair incandescent lighting plant anticipates the coming practice in this respect by using the higher tension.

The preparation for the World's Electrical Congress, which is to convene in Chicago, August 21st, as noted elsewhere in our columns, gives every indication that this congress will be as business like as its promoters have intended it should be. Being organized as planned, there will not be much opportunity for charlatans to control it. The work as laid out is such as to require the best intellect, and the prospects of securing this from all parts of the world is very encouraging.

The paper which we publish elsewhere this month on "Incandescent Lamps" emphasizes the importance of a matter which has frequently been urged before in these columns: that of the constant use of test instruments. Every central station manager appreciates the fact, especially in regard to incandescent lamps, that high efficiency and long life can only be secured by maintaining as even a current as possible. A complete outfit of thoroughly reliable test instruments costs something, but, as is well shown in this paper, the cost of such instruments can readily be saved in the lamp renewal account by closely watching the voltage of the current.

A bill before the legislature of the state of Illinois is designed to regulate the manner in which street railway and other companies shall obtain right of way over streets. It gives a city council or board of trustees authority to grant right of way provided one-half of the frontage gives consent to the building of the railway. It is a mistake we believe to grant such authority as this to local boards, without some controlling power representing the state, which shall not only guard the rights of citizens and property holders, but also protect the rights of street railways already constructed, and whose property is often greatly depreciated in value by the building of parallel lines which such a law as the one in question, if passed, would not prevent.

THE WORLD'S COLUMBIAN EXPOSITION.

An immense amount of work has been done toward completing the World's Columbian Exposition in spite of the recent cold weather, and as is shown in our columns elsewhere this month, about all that remains now to be done is to install exhibits. Naturally our readers will be particularly interested in the progress that is making in the Electricity building, and judging from present indications there is no reason why the exhibit in this building should not be fully installed by May 1st, the day of opening, if exhibitors are as prompt and energetic as the department is. It is sincerely to be hoped that every electrical concern which has secured space will further the endeavors of the department to be prompt, so that this building, which will be the center of attraction of the whole exposition, will be ready in every respect on the opening day.

THE TRANSFORMER.

There are many uses for which the alternating current is particularly adapted, and as the commercial efficiency of this current is at present dependent upon transformers it is necessary that users of it have a full knowledge of the transformers that are on the market today. The past two or three years have brought marked improvements in these devices so that as now constructed transformers have a very high degree of efficiency and their cost is only nominal compared to what it was a few years ago.

In order that our readers may be able to see at a glance just what transformers are on the market today, how they are constructed, what their design is, and how the various makes differ, we publish this month an article describing and illustrating the leading ones in use throughout this country. A careful perusal of this article cannot fail to be instructive to all users of the alternating current.

ELECTRICITY AND THE ERIE CANAL.

Governor Flower, of New York, in his annual message to the legislature calls attention to the steady decline of business on the Erie canal and recommends that the state consider equipping the canal so that the overhead trolley system which has been so efficient in street car service may be adapted in canal service. In case this were to be done the owners of the canal boats would equip their boats at their own expense with electric motors.

This proposition of Governor Flower's is very likely feasible, and from his presentation of it there would be economy in adopting it. With animal power the boats travel at a speed of about two miles an hour. By the use of electricity this speed could be increased, but because of injury to the banks of the canal by wash, were a high rate of speed made, speed is of necessity limited to about four miles an hour. Were the state of New York to undertake this work it would hardly more than be completed we believe before it would be antiquated. If electricity is to be used in any way on the Erie canal the most economic way of adapting it would be in giving up the canal itself and building in its place an electric railway. The canal from necessity is closed during the winter, but the electric railway could be used twelve months in the year, and there would be no limits to the speed that could be made except mechanical and electrical ones. A speed of two miles an hour with only six or eight months in the year to do business is certainly behind the needs of the times as business is at present done, but this is no more behind the times than Governor Flower's proposed speed of four miles would be five years hence. Each year sees greater economy and efficiency in methods of transportation, and the electric railway which is now limited almost solely to short distances and passenger traffic, will inside of the next five years be doing an enormous freight business local and otherwise, and the state of New York should heed the tendencies of the times and make the Erie canal as efficient as it would be made were it private property. If any change at all is made it should be in the construction of an electric railway.

THE ELECTRIC LIGHT CONVENTION.

Every man connected with or interested in electric lighting should plan to attend the convention of the National Electric Light Association, which meets in St. Louis the last day in this month. In many respects, this will be one of the most important meetings that the Association has ever held, and such large interests are at stake upon which the continued advancement of electrical interests are dependent that every man should consider it his duty to become a member of the Association, if he is not already one, and attend this convention. Two very important questions are: the present complicated condition of the incandescent lamp market, and the holding of the World's Columbian Exposition. So far as the lamp situation is concerned, immediate action is necessary. The committee having charge of the program has been mindful of all the needs of the time, and has arranged for a meeting which will be instructive and interesting. In connection with the lamp question, it is proposed to have two papers read, one from the General Electric Company's standpoint, and the other the outside companies' position.

Let there be a large attendance at this convention, and let every man consider it his personal duty to do his share toward making it the success it should be by interesting himself fully in it.

BAD FINANCIERING OF ELECTRICAL SECURITIES.

During the past year a number of large schemes looking toward the organization of new companies and the consolidation of old ones, both in connection with electric lighting stations and electric railways and in some instances a combination of the two, were consummated, and in most of these cases the securities were so handled as to give evidences of improper manipulation. Securities of so many such schemes were floated that the financial press is already cautioning the investing public to scrutinize investments in such organizations before paying out their money, especially as in some instances the promoters of the enterprises after floating bonds and otherwise permanently burdening the companies, unloaded their own holding on innocent stockholders. One of the leading financial papers sums up the situation as follows:

> That there is greater economy in electric power than in horse power, and that a change from the latter to the former means increased net profits, are facts which must be conceded, but one may reasonably question whether the net benefits are sufficient to justify the trebling or quadrupling of the bonded and stock capitalization as has been done in some instances recently. Well may the average investor who gets only a reflected light as to the workings of these companies, question as to how the company is to stand up under the load it has assumed—there is a limit even to the energy and possibilities of that wonderful agent, electricity, and it is very probable that within a few years it may be necessary to reorganize some of these properties which are now so full of promise—and water.

It is to be hoped these warnings will come in time to prevent suspicion and demoralization such as has occurred with other lines of securities which the same tactics brought into disrepute.

THE INCANDESCENT LAMP SITUATION.

The incandescent lamp business has become complicated almost to embarrassment during the past few weeks. All but three or four of the several lamp manufacturers are tied up by injunctions, thus curtailing materially, the output of lamps so that stations equipped with apparatus made by companies other than those controlled by the General Electric Company are in a state of uncertainty as to an adequate supply of lamps. The General company is under contract to supply lamps to the Edison licensee and to the Thomson-Houston subordinate companies, and as its factory facilities are necessarily limited, it would naturally supply these companies in advance of outside companies, and should the factories that have been closed remain so long the supply of lamps in the market will fall much short of the demand.

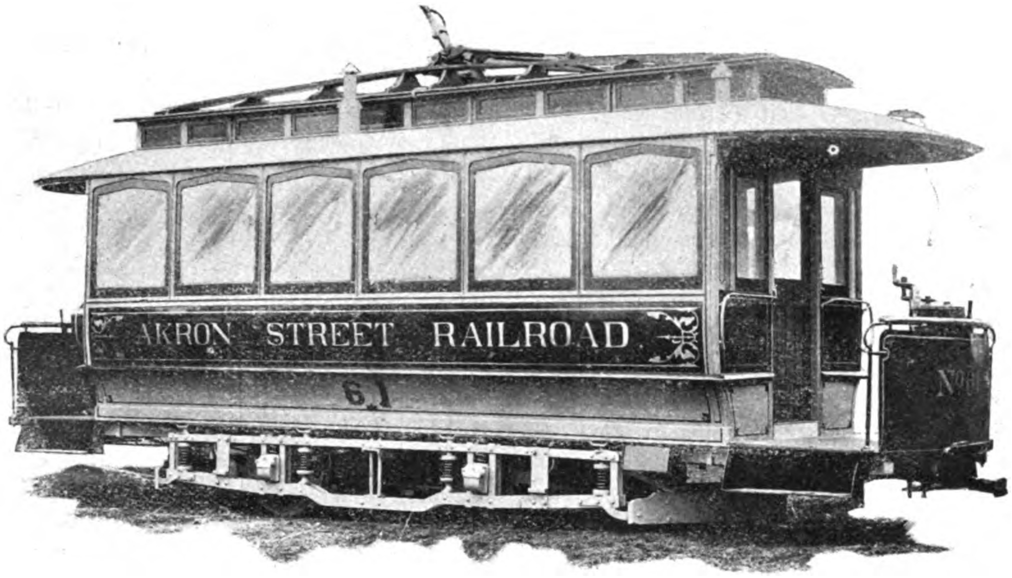
The United States Court of Appeals has decided that Edison is the inventor of the incandescent lamp, and control of the situation belongs to the owner of his patents. Within the past month evidence has been discovered which may show that this patent was ante-dated twenty years by the invention of Henry Goebel, but even should this evidence prove to be all that is claimed for it, the courts are so deliberate in their actions that no results can be expected for months to come, especially when the question involves the reversal of a decision of the Court of Appeals. How then is the demand for lamps to be supplied? The Westinghouse company is putting its new lamps on the market as fast as it can manufacture them. Other new types of lamps are promised by other companies, but even were these promised lamps perfected, months would be required to test them and equip factories to make them.

Where then is the remedy for the present embarrassment? The General Electric Company is reported as tied down by agreements which it inherited from the Edison General Electric Company and the Thomson-Houston Electric Company, but we greatly doubt if there is anything in such agreements that would prevent justice being done to all electrical interests, either by permitting the factories that have been closed to continue to manufacture lamps by paying a royalty on their output, or by leasing these plants and putting them into operation. On the face of it there does not seem to be justice or ordinary business policy in the present situation. It is not justice to hinder in any way the steady progress of electric lighting by shortening the supply of lamps, nor is it policy to antagonize the purchasing powers, or to deprive the present holders of the Edison rights of whatever royalty belongs to them, if any. We believe we are safe in saying that every one of the closed factories would pay a reasonable royalty for the privilege of continuing business, conditional upon the establishment of the Goebel claim, especially as the Edison patents have only a year or so to run, and continued litigation calls for much more money than any royalties would amount to. The situation as it stands at present smacks too strongly of "trust" methods.

A press dispatch from Ashland Wis. reports platinum as having been found in paying quantities in a mine near that town.

Akron Car Company.

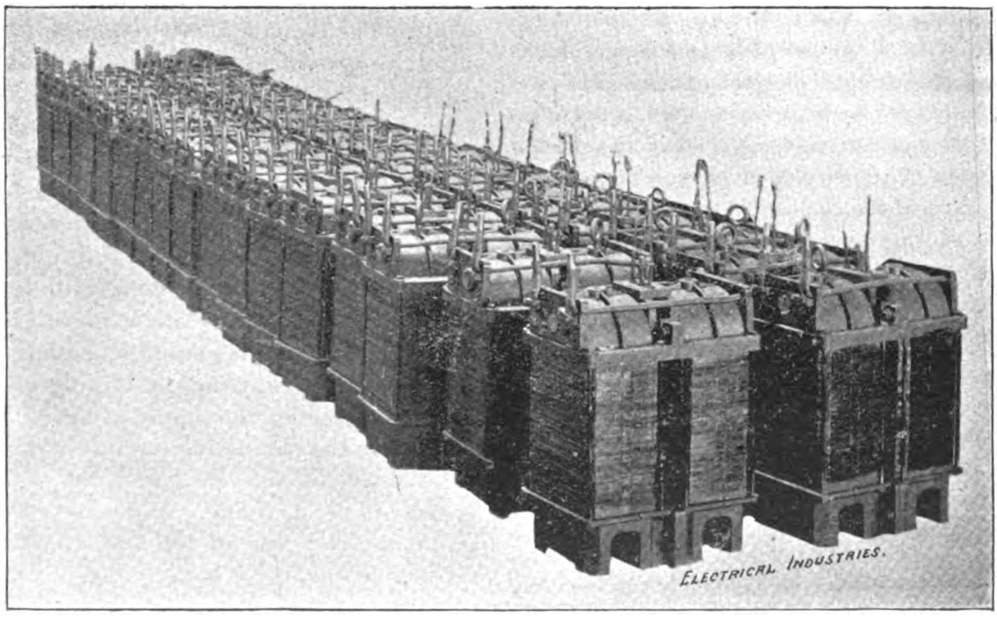
In the accompanying illustration is shown one of an order of electric motor cars recently filled by the Akron Car Company, Akron, O., for the Akron Street Railroad. The car is mounted on a Seiberling motor truck which is fitted with an improved brake. Both spiral and elliptic springs are used on this truck, and as will be seen from the illustration, the truck is simple and strong of construction. The car is built and finished in the latest improved manner, and its frame is of great strength to withstand the strains peculiar to electric motor cars.



AKRON CAR COMPANY.

Westinghouse Converters for the Fair.

Last month description was given in these columns of the incandescent lighting plant that the Westinghouse Electric & Manufacturing Company will install at the World's Columbian Exposition. It was stated also that the current generated would be of 2,000 volts, which would be reduced to 100 by transformers which were to be installed in pits just outside each of the buildings.



WESTINGHOUSE CONVERTERS FOR THE FAIR.

We are now enabled to illustrate and describe the converters which will be used for this purpose. In the accompanying illustration is shown a number of these instruments that have been particularly constructed for this service. They are made in units of 200 lights. The nature of the service at the Exposition is such that in designing the transformers the Westinghouse company was mindful of the fact that the transformers would be in service but a few months and the installation one of temporary character. The pits will contain various converter capacities up to 800 lights. The primary lines to the pits and the secondary lines to the buildings are all placed underground. The transformers are made in two parts, each of a converter for 100 lights with coils for reducing from 1,000 to 100 volts. Two of these converters are built together, and the primaries are connected in series while the secondaries are in multiple for reducing from 2,000 to 100 volts. The transformers stand upright, and it will be noticed that they are not encased. The iron plates are exposed and castings cover the ends of the coils at the top and the bottom. This form of converter was secured by combining two standard converters for 1,000 volts. It secures a large radiating surface which is especially demanded as the converters are to be installed in enclosed pits.

The Edison Meter.*

BY J. F. GILCHRIST.

The first Edison meters constructed were made of tin, shallow rectangular boxes designed to be fastened upon the wall. The boxes were provided with hinged doors of the full size of one side of the meter. The meter was divided by a shelf into two equal compartments. In the lower space were placed the heavy conductors, extending from one side to the other. The ends of these conductors were set in binding posts made to admit and secure the main circuit wires. To these binding posts the small wires of the shunt circuit were fastened. This smaller circuit included a resistance coil and the measuring bottles, the latter being connected in circuit by flexibles provided with binding posts at the loose end to be fastened to the rods of the electrodes in the bottles.

Operation proved that improvements could be made. The metal case, which demanded great care in insulation, and which also proved too flimsy to stand the work, was discarded and a substantial wooden case somewhat larger took its place. The flexible connections for receiving the measuring bottles required too much time to adjust, and also had the bad habit of getting their heads together and short circuiting the bottle or, worse yet, getting mixed with the opposite pole and putting out the customer's lights, so that in these new meters metal clips or strips of spring copper were substituted, fastened to the back of the meter and projecting forward in a way which admitted of being sprung up and down, but rigid as regarded lateral motion, and were placed just far enough apart so that the ends of the bottle electrodes could be placed beneath them and thus close the circuit when the bottle itself stood upon the meter shelf.

The three-wire type of this meter, is simply two two-wire meters placed in the same case; the two left-hand bottles measuring the current of the upper outside wire, and the two right-hand measuring for the lower one. The two bottles on one side are wired in multiple with each other, and the circuit is thus formed in multiple with the main conductor; thus the two bottles should read the same, one acting as a check upon the other. The resistants used in these meters are small coils of copper wire varying in resistance according to the size of the meters, or rather the size of the main conductors, so that the ratio of resistance of the bottle circuit to the resistance of the main circuit is the same in all sizes of meters, namely, as 1 is to 974. The measuring bottles resemble a patent fruit jar in appearance, having a glass cover provided with two small holes for the rods of the electrodes and held in place by metal screw rings, while a rubber gasket and small corks fitting over the rods into the holes in the cover prevent the fluid from spilling or evaporating. Each bottle is equipped with a pair of plates or zincs, small rectangular pieces stamped out of ¼-inch metal and having a copper rod screwed into one end for the purpose of making contact. These plates are provided with small holes, through which pass the rubber bolts which fasten the pair together, while small rubber fittings prevent their coming into actual contact with each other. The bottles are filled, so that the zinc portion of the plates is entirely submerged with a light solution of zinc sulphate. These bottles and plates vary in size according to the amount of current they are designed to measure. The smallest ones are constructed to measure a three ampere current, holding a quarter of a pint of fluid, and the plates having an electrolytic surface about ¾-square inch. From this they increase in pressure by geometrical progression, the largest bottles holding over a quart of fluid, and weighing, when prepared, five pounds. This is the meter which is most largely used in Edison stations today, and is very satisfactory, with the single exception of being quite expensive to operate.

The last meter brought out by the Edison people, known as the standard meter, has still further lessened the labor of operation, and would be more generally used were it not for the fact that it is constructed to use a heavier solution, so that it is not wise to use it with the old meter when all are operated from the same room, as a chance for error is created by getting the solutions mixed. In this meter the bottles are placed in the lower part of the meter, which is an improvement over the old style for several reasons: the fluid from the broken bottle cannot drip into the zigzag of the main conductor, and thus eat it out by the action of the current; there is less danger of the meter man making an accidental short circuit on the main wires if he is not obliged to reach up over them in changing bottles, and as meters are generally placed above a man's head they are easier to read. But the change which most facilitates operation is the use of one size of bottles in all meters. This is accomplished by varying the ratio of resistance between the main circuit and the bottle shunt in the meters of different capacity.

Whereas in the smallest meter the ratio is that of 1223:1 and a deposit of one milligram on the plates means that one ampere hour of current has passed on the main wires, in the largest meters the ratio is that of 9784:1, and one milligram on the plate means that 8 ampere hours of current have passed in the main circuit; this of course requiring a differing constant for each size of meter when making out bills.

In this meter the bottles are about the size and shape of a whisky glass, and have a large cork instead of a glass cover and rings of the old style bottle, by which much labor is saved.

The plates are also something of a departure in size and shape. When this meter was brought out the confidence in the chemical meter had become so great and the system of bottles in multiple used in checking showed so little variation from absolute accuracy that the second bottle in the smaller size of meter was deemed unnecessary, and was discarded.

Aside from these changes the meter is the same as before, being made in about the same sizes and of the same material. In the Edison meter everything depends upon operation, and in order to operate well, the first and greatest requirement is one which has not up to the present time been fully appreciated, namely, a spacious and commodious meter room, well provided with necessary apparatus and furniture, good light and all the red tape and system in the matter of handling that can be used.

For the sake of getting an idea of the necessary work and care let us follow a set of meter bottles through the mill. The zinc plates are first ground in order to clean and brighten the surface. For this a sand paper is used, run by a motor; then the tops and joints between the plates and rods are carefully painted with asphalt varnish to protect the point from the action of the mercury. After grinding and painting, the plates are amalgamated, then brushed off carefully with a stiff nail brush or, better yet, a revolving brush, and placed in racks to dry over night.

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*Abstract of paper read at the meeting of the Chicago Electric Club, January 16, 1893

When the mercury is thoroughly dry the plate is found to be covered with crystals of mercury. These must be removed before weighing. This is done by polishing them on a scratch wheel or steel buff, which removes the crystals and leaves a clean smooth surface. The plates are then wiped off with a clean crash towel to remove dust and particles of mercury and are turned over to the scale man to be weighed.

The scales used for weighing plates are the finest assayer's balances, laboratory style, and will weigh to 1-10 of a milligram. Here the plates are weighed, each one having attached a tag bearing the name of the consumer, the weight of the plate and a letter designating the position of the bottle in the meeting. Only one plate in each bottle is weighed. The plates are then made up, that is, fastened together by rubber bolts, placed in the bottles, which are filled with fluid and the covers adjusted; the bottles sorted into sets, and placed in cases, ready to be carried out to the meters. In putting the bottles into the meters the only care necessary is to see that good contact is made between rod and clip, and that the bottle is so placed that the weighed plate in each bottle shall come under the positive pole, and thus become the losing plate. This is really immaterial, as the theory that one plate gains the exact amount that the other loses is well established in practice, but it is well to have some system, and in occasional cases where the deposit is not firm, having been deposited very rapidly, it is better to have the positive plate, as nothing but current will loosen the firm, new zinc of the losing plate, while the crystals of the gaining plate may be removed by abrasion due to careless handling. The new bottles having been put in place, and the meter resealed, the old bottles taken from the meter go into the case, are returned to the meter room, knocked down, that is, plates removed from the bottles and taken apart, and are put into racks to dry. When dry, plates are again weighed, the weight being entered upon customer's record directly beneath the weight of the same plate when it left the meter room the previous month; then, having accomplished their mission, they are sent to the grinding room to go through the same form for some other meter the following month. Meter plates in ordinary use will last from six to eight months, when they become thin and small and go to the scrap pile.

Between the losses of plate from multiple bottles, an average is taken, and from this the bill is easily figured, using for convenience a previously figured constant. The action which takes place between plates when current is passed through the bottle, and upon which the entire system is based, is the same as that employed in electroplating. As we say in explaining to customers, it is a chemical action, which amounts practically to deposit of metal from one plate to the next. The exact action is this: A molecule of zinc sulphate solution is decomposed at the negative electrode; the zinc in the molecule immediately adheres to the zinc plate, while the other elements seize upon the zinc of the molecule behind, and toward the other plate, and form a new molecule; this action keeps up throughout the distance from one plate to the other until the freed element of the last molecule seizes upon an atom of zinc from the positive plate, and the chain is complete.

Mechanical Theory of Magnetism and Electricity, and Application of this new Theory to the Conversion of Heat into Electricity.*

BY LEON J. LE PONTOIS.

Briefly stated, the theory of magnetism and electricity as formulated by M. le Pontois is this: — Instead of supposing that the magnetic and electric phenomena are caused by the different modes of vibration of the intangible and mysterious fluid known as ether, which is supposed to be diffused throughout all space, these phenomena may have a much more material origin, and simply be caused by modifications under circumstances of the vibratory cadence which is supposed to constitute the permanent state of matter. These perturbations should be caused by the presence or contact of bodies whose atomic conditions are so different that the equilibrium resulting from the universal atomic vibration, is partially destroyed. The atoms strike each other until certain of them are destroyed, and this atomic battle may be called chemical reaction. A new state of equilibrium is formed out of which arises heat or electricity. In other cases heat or electricity may be generated by a mechanical destruction of movement like in a shock or by friction between certain bodies.

After amplifying and illustrating this theory Mr. le Pontois applied it to practical electrical matters by analyzing the ordinary battery, showing the atoms of the liquid, two superposed atoms of oxygen and hydrogen vibrating against and with the others, superposed of oxygen and hydrogen, in a state of perfect equilibrium. The zinc plate is introduced, and immediately a great disturbance occurs—the harmony is destroyed, water is decomposed on account of the great difference of atomic interval and atomic weights of the atom in presence. The two superposed atoms of hydrogen and oxygen cannot vibrate in harmony with an atom of zinc, a battle occurs in which they are divided, the atom of oxygen going to the zinc, hydrogen to the carbon. A new vibration takes place in which an atom of zinc superposed to an atom of oxygen, vibrates against an atom of H^2 O. In the shock an excess, of speed is given the H^2 O, and an undulation starting from the zinc and going to the carbon takes place in the battery, and if the conductor connects the electrodes, the undulation affects successively the atoms of the conductor, and this undulatory movement is nothing but the electric current.

Then considering a wire surrounding a soft iron, the lecturer analyzed the forces in presence, and demonstrated mathematically, that if an undulatory movement of said electric current flows through the wire the undulation has for effect to disturb the atomic vibration in the iron, and to establish a new mode of vibration in which one of the phases differs from the other by an excess of speed. The nature of this vibration is demonstrated as being exactly the same as the lecturer had supposed to constitute the magnetic vibration which occurs in a permanent magnet.

M. le Pontois applies briefly his theory to the dynamo, and demonstrates that in like manner an undulatory movement takes place in a conductor moving in a magnetic field, and arrives at the theory of the thermo-electric battery. Applying this theory, he gave the following description of this battery: When two metals having a different atomic state, such as antimony and bismuth, for instance, are soldered together, if the solderer's point receives a vibratory caloric movement, this vibratory movement creates in such metal an undulation, and if the metals are connected by a conductor, an undulatory movement, known as electric current takes place in the conductor. The electro-motive force, that is to say the speed of the undulatory movement, is equal to the difference between the coefficients expressing the variations of the conductibility of the metals, multiplied by the difference of temperature between the soldered point and the coolest point of the circuit. Describing the thermo-electric battery, the lecturer showed how small is the amount of heat really utilized in the generation of the thermo-electric currents, and explained at length the reasons of the inefficiency of the conversion of heat into electricity by this process. He also showed how the Thomson and Pelletier effects can be easily explained by the atomic theory, and finally explains the general outline of his thermo-electric generator. In principle it depends on the fact that thermo-electric currents can be generated in a single wire if a portion is filed away so as to make a great difference in the heat capacity of the metal in the two directions. In order to obtain this molecular change he heats and cools simultaneously two neighboring points of the circuit, so softening one of them while hardening the other; at the same time the source of heat being displaced is applied between the two points and an electric current takes place in the circuit, going from the softest point to the hardest point, through the external circuit. This principle is applied in practice in the following manner: A gas turbine is mounted on the same shaft with a blower supplying cold air, the outlets for the heated gases, resulting from combustion and the cold air furnished by the blower are placed in alternate positions on the circumference of a cylinder uniting the two bases; this apparatus, called repartitor, revolves with a very high speed inside a cylindrical cavity made by a succession of laminated rings having between them a space of 1-32 of an inch, and insulated each from the other, these rings are divided themselves in sectors, having a suitable coating to absorb the heat and at the same time prevent the oxidation.

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*Abstract of Paper read before the Pittsburg Electric Club, January 14th, 1893.

Two different points of each sector may be simultaneously affected by the discharges of hot air and cool air escaping from the nozzles of the repartitor, and the sectors are made of such shape that the currents generated circulate around an iron core placed inside each series of sectors; the iron cores made of laminated sheets coil round on their extremities. The undulatory movement generated in the sectors changes the atomic vibration of the core and magnetizes or demagnetizes it. Hence, currents of induction take place in the coils, which may be connected in order to obtain the requested voltage. The principal advantage of this disposition lies in the fact that a large metallic surface is exposed in a very short time to a great variation of temperature. Besides that the inventor demonstrated by a few mathematical calculations that the greatest part of the energy furnished by heat is utilized in the work of magnetization and demagnetization.

The experiments already made have given very encouraging results, and seem to indicate that the efficient conversion of heat into electricity is not impossible.

ELECTRICAL exhibits have been a noticeable feature in the annual fairs held in the east of late; much more so than usual.

Electricity at the World's Fair.

The Westinghouse Electric & Manufacturing Company has issued a circular in regard to the Exposition in which it says:

> "The contract for lighting the World's Fair requires the necessary machinery, wiring and lamps for a minimum of 92,000 sixteen candle-power lamps. The company will supply twelve large generators, each of a maximum capacity of 15,000 sixteen candle-power lamps. Six of these will be driven by Westinghouse Machine Company engines, having their shafts connected directly to those of the generators, and six will be belt-driven by engines supplied by other exhibitors. The total horse-power of the engines will aggregate 12,000, so that this plant will greatly exceed in capacity any of the large lighting stations of the world.
>
> The company will, in addition to the above, have a very extensive exhibit in Electricity Hall, illustrating high tension long distance power transmission, and the many forms of generators and motors made by it. The power for the operation of this exhibit will be taken from the large generators above referred to, which have been especially designed to give double currents (now generally called multiphase currents), for the operation of Tesla motors as well as for lighting. There will be in this exhibit many illustrations of recent advances in generating and using electricity, with illustrations of some especially interesting scientific phenomena.
>
> The new stopper incandescent lamps now being manufactured by this company, will be exclusively used. At least 92,000 of these lamps will be required by the time the Exposition opens, and it is anticipated that the requirements of exhibitors will increase the number to 130,000 or more. Allowing an average life of 600 hours for each lamp there will be required for daily renewals fully 1,000 new lamps. The company proposes, if it can secure the needed space, to make as part of its exhibit, a model lamp factory where it will produce new lamps and renew the carbon burners of those burned out, thereby making a most interesting and instructive exhibit, and at the same time effecting a saving in the cost of lamp renewals.

The Westinghouse Company had one of its large dynamos direct connected to a Westinghouse compound engine on exhibition at its works for several days last month. Invitations were sent to leading electricians and others throughout the country to inspect this remarkable combination. The weight of each dynamo is about 150,000 pounds, while the armature alone weighs 42,000 pounds. At this same display in the company's shops at Pittsburg the new stopper incandescent lamps which the Westinghouse company has recently perfected were formally introduced to the public.

Work is much more behind on the Palace of Mechanic Arts than on any other of the important buildings. Considerable staff work is yet to be placed on the exterior and there is a good deal of plastering and other finishing work to be done in the interior before it can be painted. The three 20-ton electric cranes are already in place and are expediting the work of handling exhibits. A temporary electric plant is now running in a chamber under the flooring near the center of the engine plant. There is a Standard arc dynamo which furnishes lights about the building and elsewhere; a C. & C. generator which furnishes power for the electric elevators in the Administration Building and an Edison dynamo which supplies current for lighting the mechanical and electrical engineering offices and lights for use about the Machinery Hall and in the Administration Building.

Work is progressing as rapidly as could be expected on the electric fountains. The piles necessary for the foundations have all been driven and construction work on the superstructure will be begun at once.

Work has been begun with much vigor in installing exhibits in the Electricity building. A railroad track has been laid lengthwise of the building, both east and west, extending the entire length of the building, so that exhibits can be unloaded from the cars almost on the spot where they are to ultimately be. The aisles and blocks giving the general layout of the floor plan have been plainly marked, and some of the larger exhibitors are already at work erecting pavilions or other structural work in which their exhibits are to be placed. The Bell Telephone Company has well under way a large structure in which its exhibit is to be made. It is immediately in front of the main entrance at the south end of the building and is elaborate and very effective in appearance. It includes stalls for showing the latest inventions in the line of telephone improvements, and ample area is at hand for a full display of telephone apparatus. The space occupied by this exhibit is 100 feet long and 75 feet wide. The floor of the structure is raised four feet from the floor of the building, and there is an entrance at each end with a broad stairway leading up to it.

The Western Electric Company is also erecting a large structure just east of the Bell Telephone exhibit. It gives evidence that this company will have an elaborate and fine exhibit, as the structure is large and finely arranged to display the different manufactures of this company.

The American Institute of Electrical Engineers will have the fine suite of rooms in the gallery at the south end of the Electricity building adjoining those of the department of Electricity. These rooms will be ample in which the Institute can hold meetings and entertain the many eminent electricians who will be in attendance at the Fair both from this country and Europe.

The General Electric Company has been granted use of an office adjoining the suite of offices occupied by the Electricity department in the south end of the gallery in the Electricity building as headquarters. The company has such a large force of engineers and other representatives on the grounds that headquarters of this size and convenience have become a necessity. This office will be in close proximity to the electric fountains, the power house of the intramural road, the Palace of Mechanic Arts, and the Electricity building, in all of which the company has large displays and interests needing constant attention.

On the main power plant in the Palace of Mechanic Arts there is a great deal of work yet to be done in the way of making installations. The foundations for the engines are all completed and a heavy oaken floor has been laid, but as yet only three engines are on their foundations; two Westinghouse engines and a Russell double tandem compound. Several other engines, however, are ready to be placed. At least half of the boiler installations are completed and some of the boilers are already in use. Two or three batteries, however, have only had their foundations laid. In the boiler house annex no boilers have been installed.

Work has been begun on installing several exhibits in the Agricultural Building and as the building itself is completed there is nothing further to do than to complete this work. In the Arts and Manufactures Building many packages of exhibits are scattered about in one place and another but work has not as yet been begun towards placing any single exhibit. The same is true of the Mining Building and the Transportation Building although in this latter building the electric transfer table is ready for use in placing the cars and locomotives that are to be exhibited on the exhibition tracks.

Mr. Willis Hawley has been appointed engineer to the department of Electricity and will have immediate charge of the work of installing exhibits in order to relieve Assistant Chief Hornsby of this detail. Mr. Hawley is an engineer of much experience having been connected with the Western Electric Company, and more recently having had entire charge of the electric plant at Urbana, Ohio.

The work of installing exhibits in all the buildings is now being vigorously pushed. A large force of men is to be put to work in the Electricity Building at once and Assistant Chief Hornsby has every reason to believe that all exhibits will be fully installed before the opening day May first.

Work of the Chicago Electrical Department.

The statement of the work done by the Electrical Inspection Department of the city of Chicago, during the year 1892, is just made public, and shows that this department not only has a large amount of work on hand, but that this work is increasing very rapidly.

During 1892 there were inspected 5,046 arc lamps. In previous years there had been inspected 14,441 lamps, making a total of 19,487.

The number of incandescent lamps inspected during the past year was 101,668. Those that had been inspected in previous years aggregated 190,282, giving a total of 291,950 of these lamps that have been inspected. This shows an enormous increased use of incandescent lamps during the past year.

The number of motors that were inspected last year was 504. In previous years it was 668, the total being 1,172. During the past year there were also inspected 188 installations which were "wired only," while the generators thus inspected numbered 345. These figures give some idea as to the rapidly increasing use of electric motors.

During the year 1892 the number of arc lamps re-inspected was 2,082, and the number of incandescent lamps re-inspected was 30,998.

A table of inspections of electric lamps made by this department, from February 14, 1884, to January 1, 1893, shows the rate of progress which electric lighting has made in this city during those years. This table is as follows:

Year.	No. of Arc.	No. of Incdsct.
1884	1,148	1.885
1885	329	7.609
1886	479	5.225
1887	837	5,424
1888	2,369	17,717
1889	2,623	24.966
1890	2,682	39,543
1891	3.974	87,913
1892	5,046	101,668
Total	19,487	291.950

Canadian Electrical Association.

The Canadian Electrical Association held its convention at Toronto Jan. 25th and 26th at which a very interesting program was carried out. Two papers that attracted much attention will be found elsewhere in our columns this month.

Underground Construction.*

BY W. A. TOWER.

It is only within the last seven years that underground conduits for electrical purposes have been constructed to any extent, although as early as 1808 Somering, a Russian scientist, exploded mines electrically through an underground wire a mile long, and in 1837 Cooke and Wheatstone operated the first practical telegraph system in the world by means of underground wires. At that time the art of insulation was in its infancy, and the underground system was soon abandoned for the overhead wire.

Within the last few years, however, the insulation of wires and cables for underground work seems to have been nearly perfected, and at the present time we have reason to believe that we will never be troubled on that score if proper care is taken in manufacturing and laying the cables.

As my experience has been chiefly confined to underground construction in connection with telephone work, the descriptions in this paper refer to that class of construction, although electric light cables could be put in the same style of conduit.

The first work of burying wires in America was done in Washington, D. C., but I believe the system did not work satisfactorily, and is to be, or has been remodeled. The next work of any importance was done in Chicago, when they adopted the drawing-in system, the only practical system for telephone work at the present time.

A drawing-in system is one where any number of ducts can be laid and used at any time without having to dig them up, or having to lay the cables at the time the conduit is laid. This system does not necessitate the use of any particular material, or make of conduit, of which there are a great many; the principal ones are: First, iron pipe; second, cement-lined iron pipe, and third, the Wyckoff. There are several others, but most of them have been discarded for various reasons, while others I have never seen and cannot give any description of them.

In building an iron pipe conduit, after the trench has been dug, a layer of concrete about three inches thick is laid, wide enough to allow an inch or more between each pipe, and three inches on each side. A row of pipe is then laid, the pipes' lengths vary from 14 to 22 feet, and are screwed together by regular threaded couplings. After this is done, concrete is put on, filling the spaces between the pipes and the three inches on each side. The concrete is then leveled off about one inch above the pipe. Another row of pipe is then put down, and the process repeated until the proper number of ducts has been laid. The top layer of the pipe is then covered with three inches or more of concrete, and the trench filled in.

The cement lined pipe comes in lengths of about eight feet with beveled male and female ends, and is laid in the same way as the iron pipe. The joints are made by bringing male and female ends together, and covering the junction with neat cement.

The Wyckoff conduit consists of pieces of thoroughly creosoted wood, about 8 feet 4 inches long, 4½ inches in diameter, with a three-inch hole through the center, the ends counter-bored and tenoned. There is first laid an inch-and-a-half board in the bottom of the trench, which is wide enough to hold the proper number of ducts. The ducts are then laid on this, layer by layer, the joints being made by joining the male and female ends about half the length of the tenon, when hot pitch is poured in, and the lengths then driven together. After the ducts are all laid, an inch-and-a-half board is placed on top to protect the ducts from the picks of workman digging across the line of the conduit.

This all appears very simple to those who have had no experience with this work, but some of the difficulties which have to be overcome are by no means trifling. In the first place, after deciding upon the route to be followed, it is necessary to find out whether there is room enough on the street to lay the conduit, as the gas mains, water mains, and other pipes may have been laid before the conduit was thought of. The engineer or superintendent of construction applies to the city and gas company for the location of their mains, which information, as a rule, is given very graciously, but in three out of five cases the position given is not correct within two or three feet and about the only use made of the information is to tell on which side of the street the mains are, and, consequently, test holes have to be dug to locate the pipes before the work can be started. As a general rule the bottom of the conduit is put below the level of the gas mains, and when a corner is reached it is often necessary to carry part of the ducts over the mains, and part under them. In some of the larger cities of the States where there are two or three gas companies, the conduit trenches at street intersections often have to be as deep as ten feet, on account of the numerous pipes that cross one another at such points. The manholes are usually located at street intersections, and consist of chambers about seven feet long, five feet wide, and seven feet deep with brick walls laid in cement, and a cast iron head and cover generally made to bolt down tight to keep out water. After the conduit is laid and manholes built, an entrance must be obtained to the telephone building, which too often has been built without proper consideration for the handling of cables. The largest telephone exchange in the States has this fault; the first cables were pulled into the bottom ducts, and it was found that it would be impossible to ever get at them again. The consequence is, that if a cable gives out it will have to be left, and the duct sacrificed. I do not think there are two exchanges which have the same appliances for handling cables, every engineer having a different idea as to how it should be done, and as yet a perfect system has not been adopted anywhere.

In pulling-in cables, we first have to get a rope through the duct. This is done with wooden rods, about four feet long, equipped with malleable-iron couplings. A rod is inserted into the duct which is to be used, a second one jointed on to it, and both pushed into the duct; this process is repeated until the rods extend to the next manhole. A rope is attached to the first rod, and the rods and the rope pulled back into the first manhole, and the rods uncoupled as they are pulled out. The rods are handled quite easily, two men being able to rod 400 feet of conduit in about fifteen minutes. The rope is then fastened to an iron clevis, about 10 inches long, made to fit the cable, and riveted to the end of it. The reel of cable being on a holder, the cable is then ready to pull in, which is done with a winch geared to an upright shaft with a sliding drum, and so arranged that the drum can be placed exactly opposite the duct through which the cable is to be drawn, thereby avoiding pulling the cable around, or over any corners of the conduit.

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*Read at the convention of the Canadian Electrical Association, Toronto, Ont., January 25th, 26th, 1893.

After the cables are in the splicing has to be done. This operation requires the greatest of care, and only thoroughly reliable men should ever be employed to do this work. In making a splice, the cables from each way are bent into their proper places in the manhole, and then cut to the proper length, which allows the ends to lap about a foot. The lead is then stripped off each end the length of the lap, and a piece of lead pipe, large enough to cover the wires when spliced, is then slipped over one of the ends, the wires are separated in pairs and turned back as far as the lead is stripped.

Two pairs of the bottom wires—one from each end—are then taken, and the insulation stripped off, care being taken not to nick the wires. A paper sleeve is then put on one end of each wire, the wires twisted together, and the sleeve slipped back over the junction of the wires. After all the pairs are joined in this way, they are boiled out with hot paraffine to vaporize any moisture that may have been absorbed, while making the splice. A piece of paper is bound around all the wires to keep the paper sleeves in position; the lead sleeve is now pulled over the splice, and a regular plumber's joint wiped.

Before a splice is started, the cable is tested back to the office, or to the point from which it starts, for open and grounded wires; the length to be spliced on is also tested in the same way, and if any such wires are found they are spliced together, so that although there might be a faulty wire in every section of the cable there would still be only one bad wire from end to end. If the testing were not done, a faulty wire in one section might be spliced to a good wire in the next, and so on; in which case, the more sections of cable the more faulty wires there would be in the entire length. After all the splices are made, and the pole or building terminal put on, the wires are tested out and put on corresponding binding posts at each end. A capacity and insulation test is made, and if it is up to the standard the cable is ready for use. At present the insulation must be at least 500 megohms per mile, and the capacity at most .08 microfarad per mile.

Meeting of the Advisory Council World's Electrical Congress.

A meeting of the Advisory Council of the World's Congress of Electricians was held at the rooms of the American Institute of Electrical Engineers, New York, on Jan. 17th, by the following: Dr. Elisha Gray, Chairman, Prof. William A. Anthony, Prof. Charles R. Cross, Dr. Louis Duncan, Dr. William Geyer, Mr. Carl Hering, Mr. George A. Hamilton, Prof. F. B. Crocker, Mr. A. E. Kennelly, Mr. T. D. Lockwood, Mr. T. C. Martin, Mr. George M. Phelps, Dr. M. I. Pupin, Mr. R. W. Pope, Prof. H. A. Rowland, Dr. Herbert Laws Webb.

The preliminary reports of the English and American committees were received. It was resolved that the congress shall consist of two chambers, of which the legislative chamber shall decide on units, names of units, and standards, and shall consist solely of delegates named by their respective governments. A committee was appointed to determine the total number of official delegates and their apportionment to the various countries to be represented.

The following apportionment of delegates was made by the committee whose report was adopted by the meeting: Great Britain 5, France 5, Germany 5, Austro-Hungary 5, United States 5, Belgium 3, Italy 3, Switzerland 3, Holland 2, Denmark 2, Norway and Sweden 2, Russia 2, Spain 2, Portugal 1, British North America 1, Australian Colonies 1, India 1, Japan 1, China 1, Mexico 1, Brazil 1, Chili 1, Peru 1, Argentine Republic 1; making a total of 55 official delegates.

It was resolved that a committee on invitations be appointed by the chairman, this committee to consist of five members who shall select and recommend to the chairman the names of electricians, electrical engineers and others who shall be members of the congress. Said committee to co-operate with the foreign committees.

It was further resolved that in addition to invitations to deliberating and voting members of the congress, a general intimation shall be extended through the journals or otherwise that the meetings will be open to the public, for attending the proceedings, but not for taking part therein.

It was resolved that a committee on program and papers be appointed by the chairman. This committee shall consist of eight members, whose duty it shall be to invite, receive and consider papers and other documents relating to the work to be done by the congress. And it was further resolved that it shall be the duty of this committee to formulate a program for the congress.

It was resolved that the reports of the English and American sub-committees which were received at the meeting should be referred to the committee on program and papers, and that the committee confer with the English committee as fully as possible.

It was resolved that the congress shall last one week, beginning on August 21st.

It was resolved that a committee of three be appointed by the chairman as a finance committee.

It was resolved that an executive committee of five shall be appointed by the chairman, said committee to have full power to act for the advisory council.

It was resolved that the question of charging a fee for membership of the congress, and fixing the amount of such fee be referred to the executive committee.

At a subsequent meeting of the council four committees were decided upon to take up the active work in connection with preparations for the Congress.

Executive Committee.—Prof. Elihu Thomson, Enos M. Barton, G. M. Phelps, F. S. Terry and Prof. B. F. Thomas.

Finance Committee.—B. E. Sunny, Prof. E. J. Houston and W. A. Kreidler.

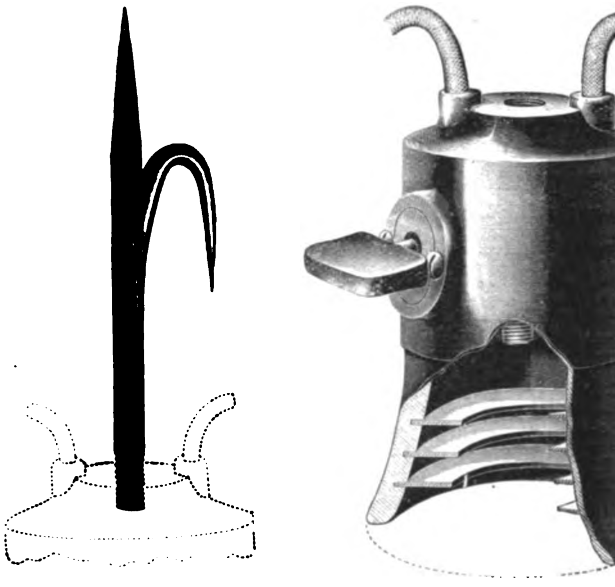
Program and Papers Committee.—Prof. H. A. Rowland, Prof. H. S. Carhart, Carl Hering, A. E. Kennelly, Prof. W. A. Anthony, Prof. F. B. Crocker, Prof. E. L. Nichols and Prof. T. C. Mendenhall.

Invitations Committee.—T. C. Martin, Dr. Louis Duncan, Prof. C. R. Cross, T. D. Lockwood and C. H. Wilmerding.

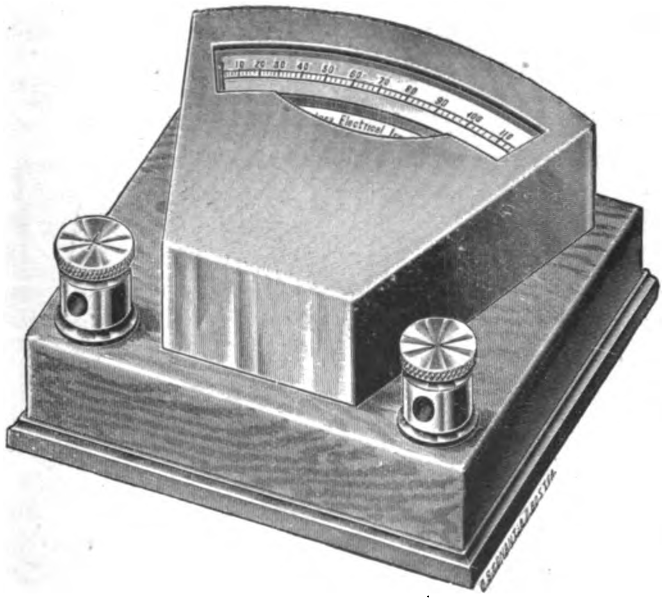
Of all these committees, and any others that may be formed, Dr. Gray is a member ex-officio. He will participate actively in the work of each. It is proposed to establish headquarters for the congress at Chicago at an early date, at which Mr. R. W. Pope, the secretary of the American Institute of Electrical Engineers, will probably be stationed to carry on all the detail work in conjunction with Prof. H. S. Carhart, the acting secretary.

Cutter's Mine Socket.

Incandescent lighting has worked its way into mines and tunnels to but a limited extent, as many sockets on the market were not adapted to this severe usage. There are a number of so-called water-proof sockets made of glass, porcelain or rubber, which apparently shield the interior of the socket from dripping water. But they do not prevent the moisture from creeping up on the lamp and over the cap, thus short-circuiting the lamp and leaving everything in darkness. In the new "Mine Socket" illustrated herewith these points have been considered, and the device is said to be absolutely water-proof. The key socket shown in the cut has a well built interior (with porcelain insulations) protected by a casing of polished hard rubber. The leading-in wires are cemented into the shell, while the handle or key passes through a series of water-tight bushings. Then there are a set of soft rubber rings which press against the bulb of the lamp when screwed into place, and prevent any moisture from reaching the lamp base. Such a socket can be used with safety in a very damp atmosphere, or in places where water is continually dripping over the lamp and socket. This socket is made either with or without key, and when intended for use in mines it is fitted with the prong-hook shown, which allows it to be supported in any convenient position. These devices are made by George Cutter, Chicago.



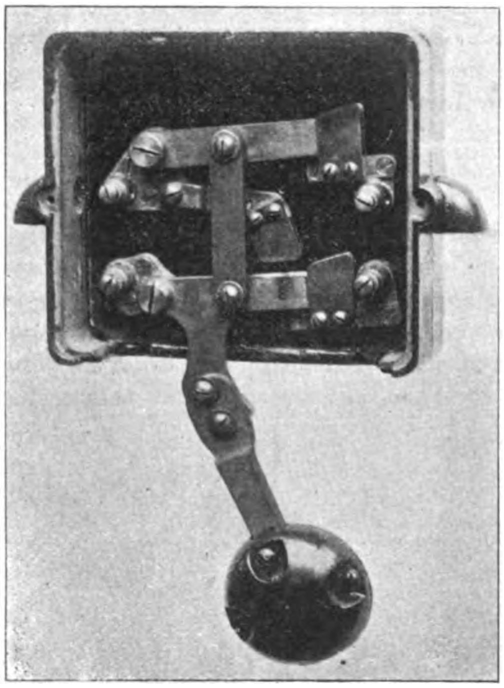
CUTTER'S MINE SOCKET.



WHITNEY ELECTRICAL INSTRUMENTS.

Whitney Electrical Instruments.

The accompanying cut represents the general appearance of the Whitney ammeters and voltmeters which are being placed on the western market by the Electric Appliance Company, Chicago. The instruments are of the permanent magnet type, the magnets being "aged" by a special process calculated to make them retain their magnetism constant for an indefinite period. Every instrument is hand calibrated and subjected to the severest possible test before leaving the factory. The voltmeters are intended for both switchboard and testing purposes, and are divided into class "A" for intermittent work, and class "B" for continuous work; that is class "A" are to remain in circuit for short periods only, while class "B" may be kept constantly in circuit. The instruments are provided with a mechanical dead beat attachment operated by simply touching a button, and intended to facilitate the taking of rapid readings.



TURBAYNE MAST ARM CUT-OUT.

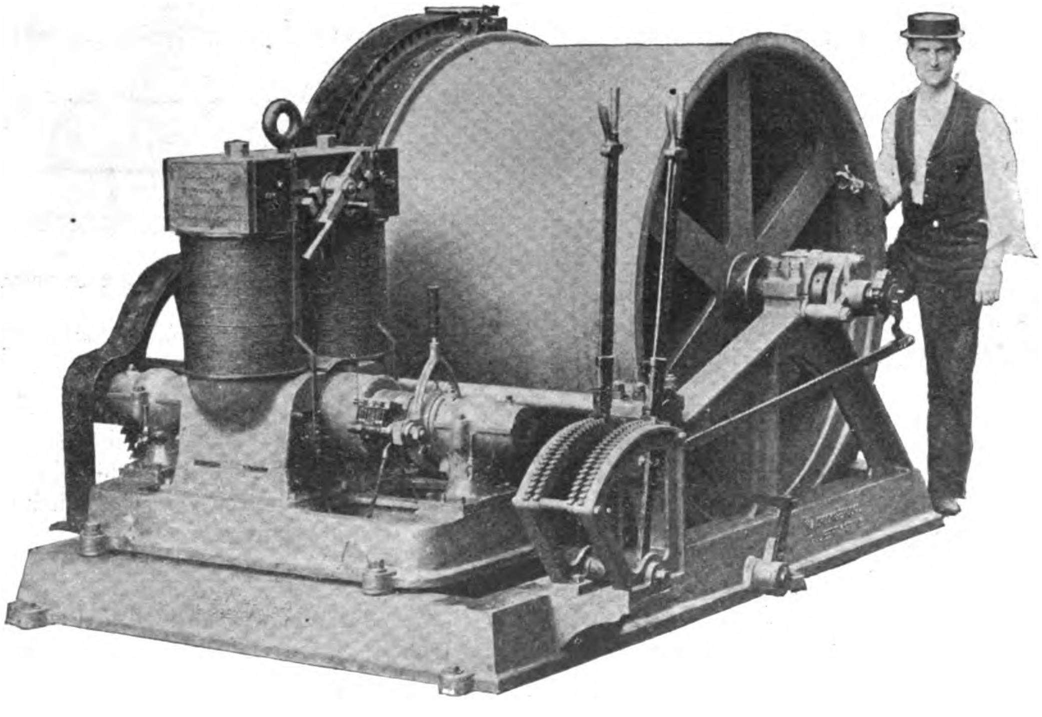
Turbayne Mast-Arm Cut-Out.

On account of the high potential that exists in the operation of arc lights for street lighting, every possible precaution should be taken to prevent accident to employes in adjusting lamps when the current is flowing; or, as is often the case, when the circuits are grounded and the earth is damp. It is the grounded circuit which is to be feared most, inasmuch as the potential difference between the earth and the metallic portions of the lamps, may equal, or nearly equal, the initial potential difference at the dynamo terminals; such as would be the case if the line was grounded at or near the last lamp in circuit. Trimmers often receive shocks, which could have been prevented had a proper cut-out device been placed in connection with each lamp. This device must necessarily be automatic, and, as the mast-arm is now being mostly used for street lighting purposes, it opens up the possibility for such a cut-out.

One of the latest devices for this purpose is the "Turbayne" mast-arm cut-out. The accompanying illustration will show at a glance its method of operation. It consists essentially of a two way switch, to the insulated lever of which is attached a pendulous weight, and an iron weatherproof casing, to the back of which and cast integrally therewith, are the bases of the clamps used for connection with the mast-arm. The electrical connections are massive and substantial and no sparking occurs when making or breaking the circuit and more especially as it never controls more than one lamp. The parts are readily accessible and wires are cut and inserted into the binding posts before they enter the lamp. This cut-out is endorsed by the Detroit Electrical Workers' Union and has been adopted by the Detroit City council, for use on all mast-arms in the city. This device is manufactured by the Turbayne-Tamblyn Company, Detroit.

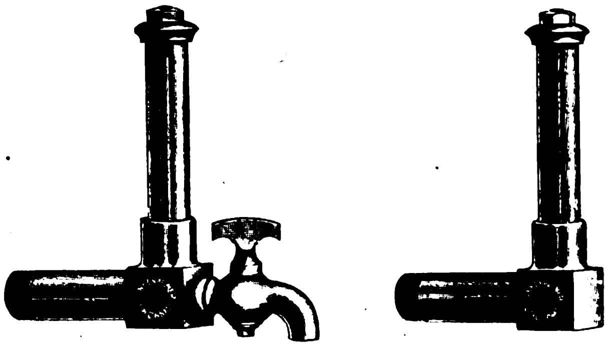
Improved Mining Hoist.

A new electrical mining hoist has been recently brought out by the General Electric Company, which is constructed with the especial object of obtaining a wide range of hoisting speed, to which end the controlling apparatus has been carefully perfected. The drum is of unusually large diameter and is connected by an intermediate gear to the armature shaft of a 25 kilowatt, (30-horse power) motor of this company's regular bi-polar type. The controller for the motor, which is not shown in the accompanying cut is similar to that used in street railway service, and is erected on a separate support conveniently within reach of the operator and directly to the right of the levers. These can then be operated with the left hand, and the controlling switch with the right. The series method of electrical control is adopted, the speed being increased or decreased to meet requirements by the movement of the switch handle. The hand brake is of the band type lined with wood, and extends almost entirely round the drum. The drum is thrown into operation by a clutch operated by the second lever. The range of speed obtained on this hoist is very wide. It is designed to raise loads of 1,300 pounds at a rate of 600 feet a minute. The motor is erected on its own bed-plate bolted to the bed-plate of the hoist proper, the whole apparatus occupying comparatively little space.



IMPROVED MINING HOIST.

Oil Gauge for Dynamo Bearings.



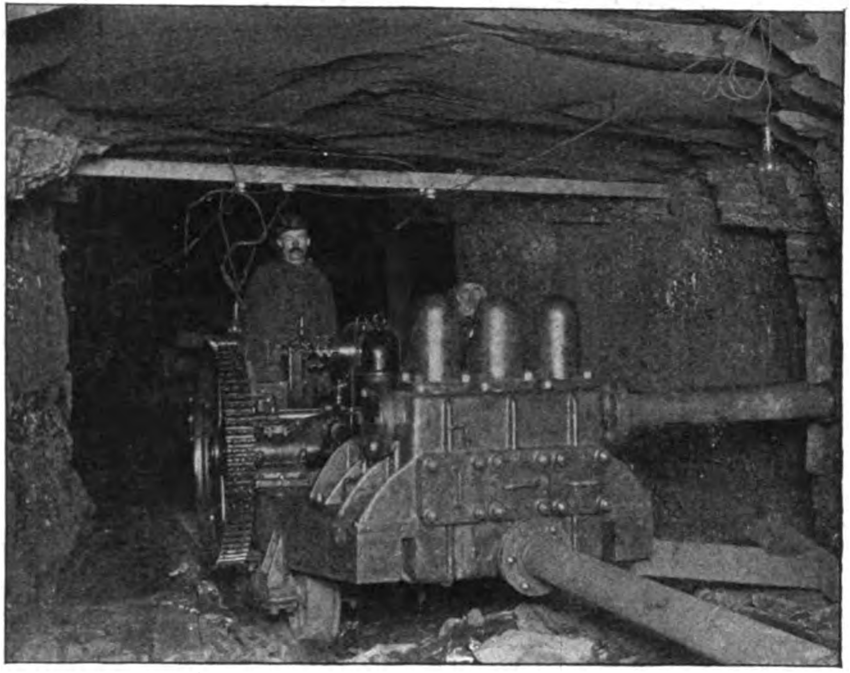
OIL GAUGE FOR DYNAMO BEARINGS.

The oil gauge illustrated in the accompanying cuts is a device that the Lunkenheimer company, Cincinnati, O., is now putting on the market. It is a very simple and practical device, and is designed especially for dynamo bearings. The exterior of the glass tube presents a free and unobstructed view, and the whole design of the gauge is such as to make it most readily adapted to this service

President Whitney, of the West End Street Railway, Boston, Mass., is reported as doing a very generous act. By the recent destruction of barns belonging to this company, three employes who were endeavoring to save property were caught by the fire and lost their lives. President Whitney promptly saw that the men were given fitting burial and gave the families of each $1,000, without waiting for the court to decide whether he should pay them anything or not.

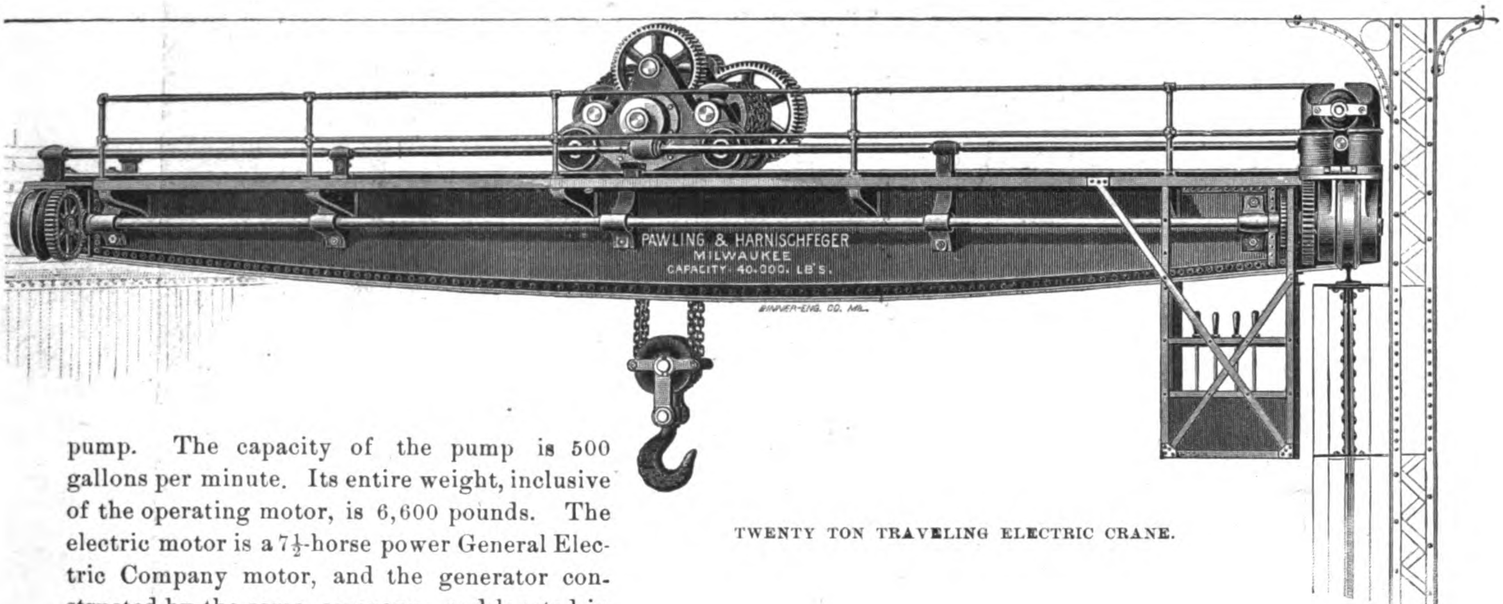
Electric Mining Pump.

An excellent example of the manner in which electricity is displacing steam in the mining industry is given by the recent installation in the William H. colliery of the Connell Coal Company, Duryea, Pa. This is the first electric pump introduced in the mines of that section. The pump is of the horizontal, triplex or three plunger style, with 6½-inch plungers and 8-inch stroke. It makes 42 revolutions per minute, and, in its present location, throws a steady, solid stream of water through a 4-inch pipe a distance of 500 feet from the lower workings to the main pump. The capacity of the pump is 500 gallons per minute. Its entire weight, inclusive of the operating motor, is 6,600 pounds. The electric motor is a 7½-horse power General Electric Company motor, and the generator constructed by the same company, and located in the main engine house on the surface, is of 10-horse power. The power is transmitted to the motor over copper wires running down through the air shaft and along the roof of the mine for a distance of 1,700 feet. The pump and motor are mounted upon a wheeled truck, and can thus readily be transported to any point in the workings. This quality alone is a strong recommendation to mine managers. The generator also furnishes current for lighting the mines.


ELECTRIC MINING PUMP.

Twenty Ton Traveling Electric Crane.

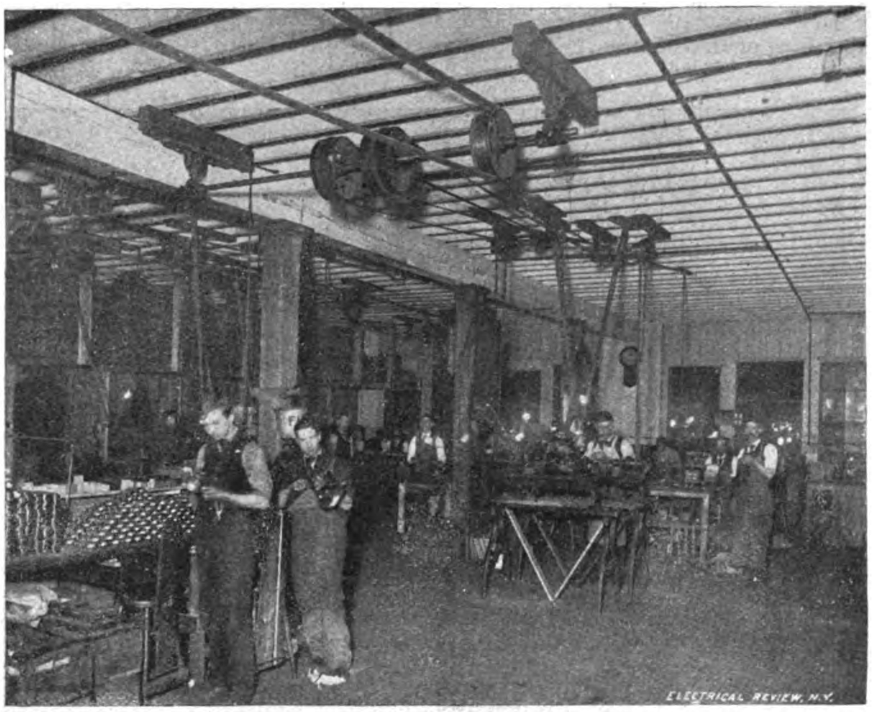
The accompanying illustration shows an electric crane manufactured by Pawling & Harnischfeger, Milwaukee, Wis., for a foundry in that city. This crane has a lifting capacity of 20 tons, a lift of 25 feet and a span, center to center of rails, of 40 feet 2 inches. The total head-room, from base of tramway rail to tie of truss, is 6 feet 3 inches, and the length of crane over all is 41 feet 4 inches. The crane is operated by a single motor which is controlled by a lever in the operator's cage, and the operations of hoisting, traveling and trolleying are effected by levers and clutches specially arranged for the purpose. As the motor is reversible, a difficult or delicate hoist is easily made by simply handling the motor lever—a matter of great importance in setting cores and copes in a foundry; while, for ordinary work, the motor runs continuously in one direction, and the other movements are obtained by the clutch mechanism, as in an ordinary power crane, except that in this case, the motor can be adjusted to give any speed desirable.



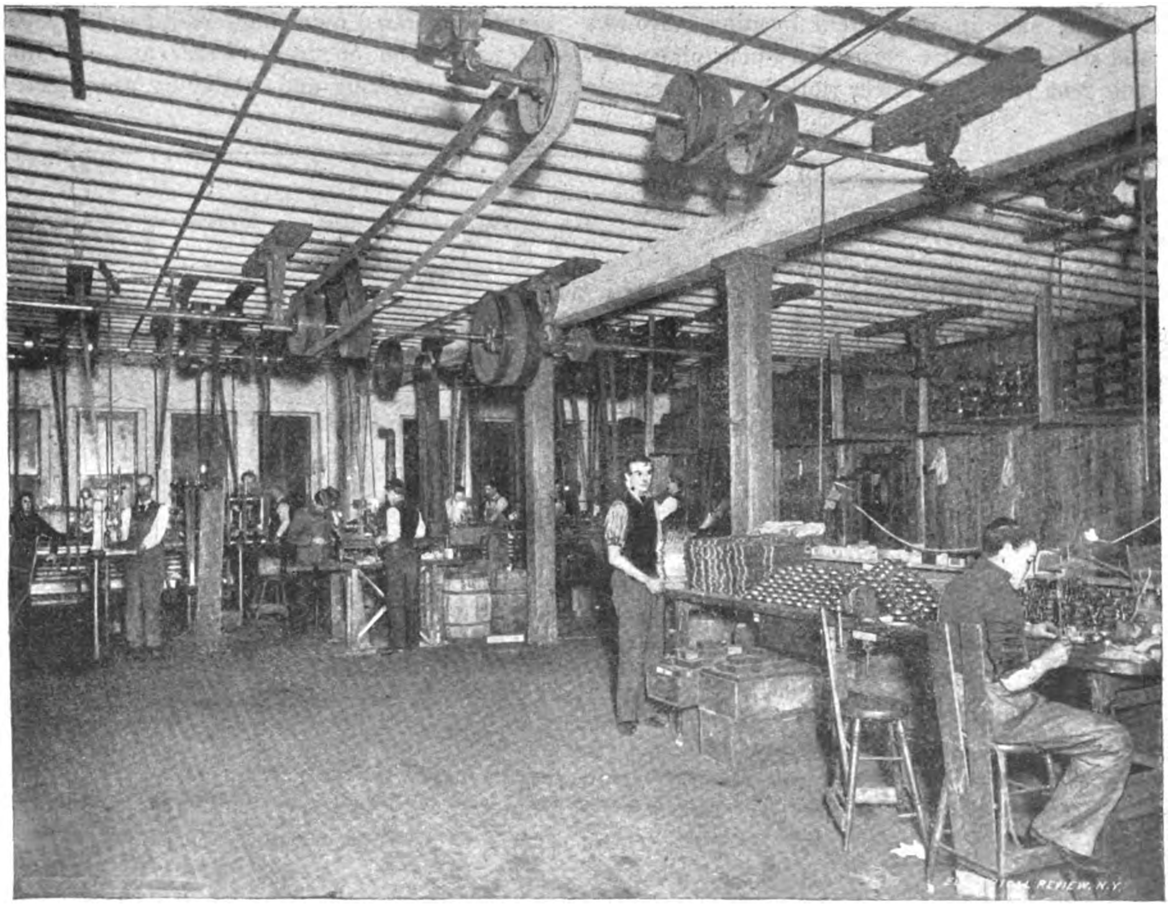
TWENTY TON TRAVELING ELECTRIC CRANE.

New Quarters for the Electric Gas Lighting Company.

In August, 1880, at the time when gas lighting by electricity was rapidly increasing in popularity, a company was organized at Bath, Me., known as the National Electric Gas Lighting Company, with a capital of $500,000. The business of the company was in Boston. As only a small fraction of the capital stock was paid in, however, the enterprise lagged. A year later Mr. Louis W. Burnham was induced to become president and manager of the company. Some of Mr. Burnham's friends also became interested and plenty of money came into the company with this new life. Valuable patents were purchased, infringements were followed up and business was put on a substantial basis. Shortly afterward the company was reorganized under the name of the Electric Gas Lighting Company and the capital stock was reduced to $250,000. For a few years the various devices handled by this company were made by contract with other manufacturers. Toward the close of 1885 the company determined to start its own shops, and a small factory was opened in Boston giving employment to about a dozen men. This small space was soon outgrown and in 1886 a new and much larger factory was taken at 173 Devonshire St.



NEW QUARTERS FOR THE ELECTRIC GAS LIGHTING COMPANY.



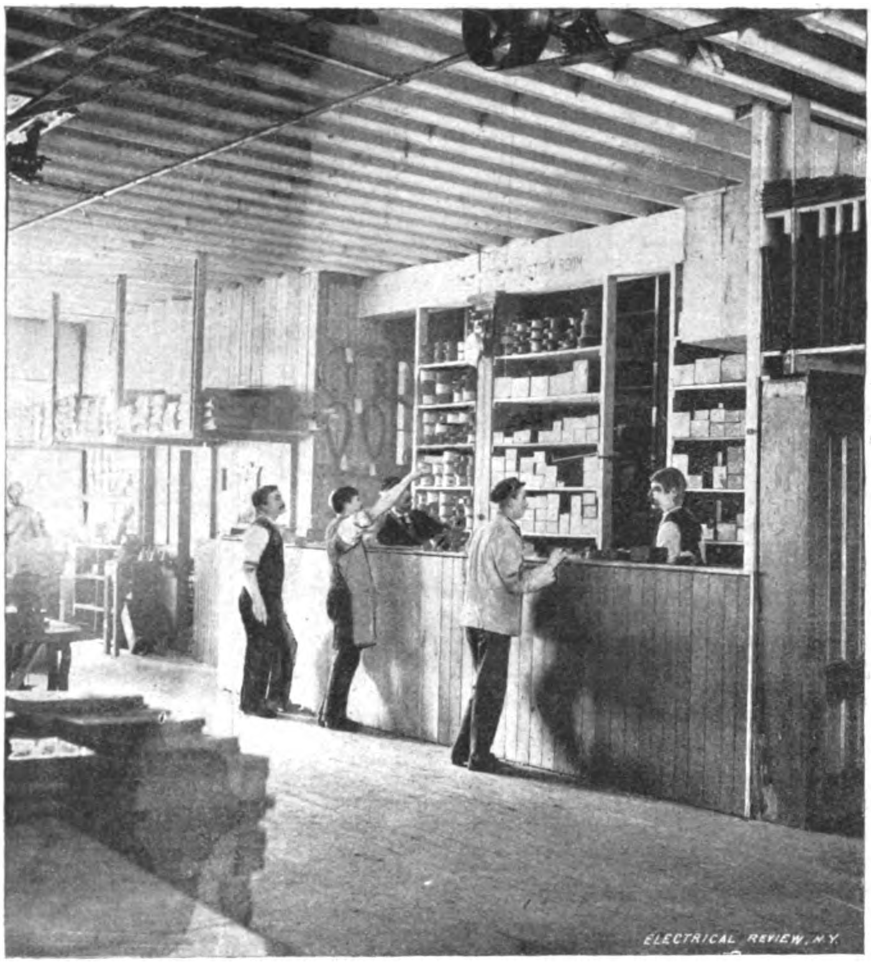
NEW QUARTERS FOR THE ELECTRIC GAS LIGHTING COMPANY.

Meantime the capital stock of the company was reduced to its more legitimate basis of $100,000. Several prominent business men of Boston and vicinity became interested in the company and Mr. Burnham was chosen vice-president and manager. This is really the starting point of the present prosperous company. During 1885 sales of specialties amounted to $15,000, and with the new management business was pushed with much vigor and sales increased, year by year, until during the past year they amounted to $150,000. The business of manufacturing strictly electric gas lighting apparatus was somewhat limited and with constant infringements of patents expenses were large and profits limited, so that in 1886 it was resolved to enlarge the field of operation by manufacturing domestic electrical devices. The store at 35 Arch St. was leased Jan. 1st, 1887, and was occupied for three years when the spacious storerooms at 195 Devonshire St. were taken. With the increase of business that came with the enlargement of operations, larger factory facilities became necessary and the company has now leased ample space at 240 Dover St., where there is plenty of room to handle the constantly increasing trade. The floor area is 6,000 square feet and every facility is at hand for turning out the best work expeditiously. Mr. Thomas W. Lane continues as superintendent of the manufacturing.

Work in the factory is divided up into distinct departments. Opening out from the office quarters is the storeroom, while beyond is the buffing room and adjoining this is the plating room and the Samson battery zinc quarters. Adjoining is the machinery department with a full outfit of machines of all kinds, while in the front of the building are the assembling rooms where the various burner parts are put together and the finished work prepared for the market. Other departments are, the bell and cut-out department, the annunciator department and the wood working, lettering and special departments. In the shipping room is every convenience for arranging and handling stock.

The growth of the business of this company is highly complimentary to the persistent energy with which Mr. Burnham has devoted himself to it. Recently he has taken in his son, Mr. Wm W. Burnham, who has been made treasurer of the company and who is active in the management of the business affairs, as is also Mr. Arthur Drew, the secretary. A year ago a branch office was opened at Chicago, under the charge of Mr. C. E. Lee, and a very large volume of trade has been worked up from this office, so that now a large stock of all the specialties manufactured by this company is carried in Chicago, as also in the home office.

The accompanying illustrations will show what ample facilities this company has now at hand in its new establishment for the manufacture of its specialties.



NEW QUARTERS FOR THE ELECTRIC GAS LIGHTING COMPANY.

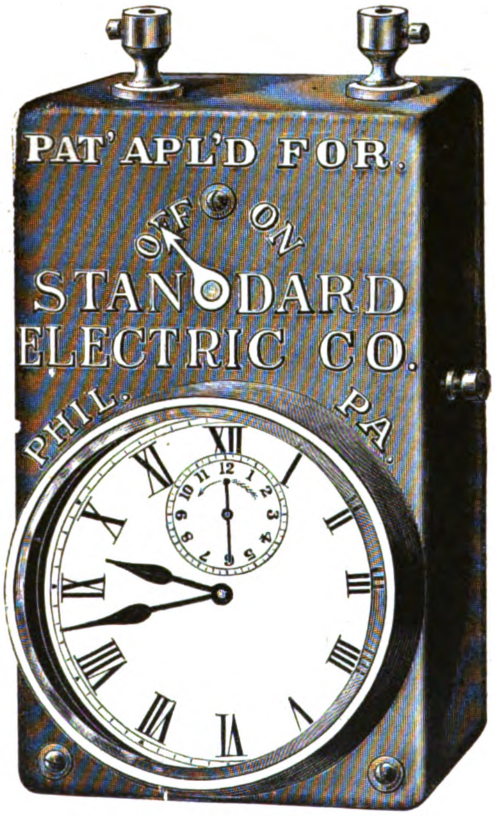
Representative Nohe, of Chicago, has introduced a bill in the Illinois legislature authorizing incorporated towns and villages in the State of Illinois to purchase and operate gas and electric light works. The measure provides as a safeguard that members of the city council and boards of trustees in such cities and villages shall be excluded from financial interest in the same. It also gives power to the city authorities to raise the necessary funds by means of taxation. The income accruing from such public works will be applied in the payment of interest on bonds or money borrowed for construction, any surplus to be applied in whatever manner the council shall deem best.

The *Manufacturers' Record*, Baltimore, Md., published a review last month of the industrial situation in the south for the year 1892. This review reports 124 electric light and power plants as having been organized during the year, as against 165 during the year 1981. Of these companies which were organized it should be said, however, that not all of them consummated their purpose to build a plant. The outlook for the coming year for the building of new plants is believed to be more encouraging than it was a year ago.

Elevated railways operated by electricity will be a novelty no longer, as one has just been put in operation in Liverpool, Eng., with much ceremony, and another is about ready to be in operation in Baltimore, Md.

Growth of the Knapp Electrical Works.

Among the companies in Chicago that were dealing in telegraph apparatus and other electrical supplies before the advent of electric light, was the Railway Telegraph Supply Company which had quarters at the corner of Fulton and Union Sts. In 1884 Mr. Myron A. Knapp, who had recently come to Chicago became interested in the company and planned at once to enlarge its field of operation at the time that electric lighting was first coming into vogue. Previous to this time Mr. Knapp had been engaged in the lumber business, but what he lacked in knowledge of electrical matters he made up in amount of energy. He first secured control of the company, then changed its name to the Knapp Electrical Works. As the location was somewhat distant from the business part of the city and the quarters altogether too cramped for much enlargement Mr. Knapp moved to his present situation on Franklin St. and started a little shop in the second story, while on the ground floor he had his offices, sales room and store room. It was somewhat of a novelty in those days to run a shop in connection with a supply house, but Mr. Knapp found contracts enough to keep a few men busy and was compelled to gradually increase his working force in order to keep up with the demands of the business. Beginning with the manufacture of a few supplies he extended his facilities until now he occupies the entire building and employs a large force of men in making the various supplies called for in electrical work, including the manufacture of telegraph instruments and apparatus.



STANDARD AUTOMATIC TIME CUT OUT.

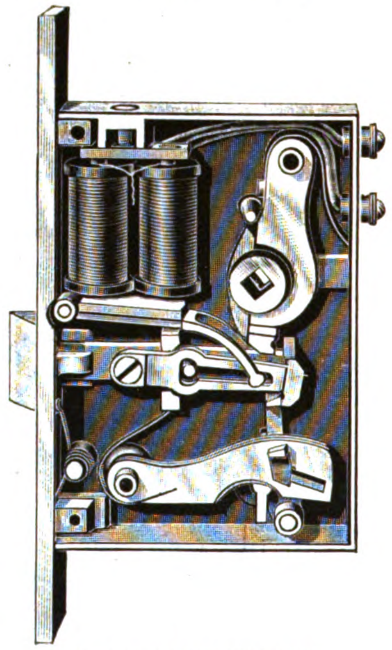
The sales room on the ground floor is now stocked with a full supply of all electrical devices and several leading specialties are handled solely by this company in Chicago. Mr. Knapp has associated with him, Mr. J. B. Wood, who is assistant manager, and Mr. M B. Austin, who is special agent. This company is now one of the foremost supply houses in the west.

Standard Automatic Time Cut-Out.

The accompanying illustration shows the Standard automatic time cut-out which is designed to extinguish lights at a specified time without the intervention of an attendant. Its working is thoroughly mechanical and in no way depends upon electro-magnetic switches. Its operation is simple. The clock work is wound up and the cut-out hand set at the time desired to have the lights extinguished. The action of this device completely cuts out the main circuit and at the same time cuts out the meter. This device is made to extinguish from one to 150 incandescent or from one to 30 arc lamps and larger capacity will soon be manufactured. It is manufactured by the Standard Electric Company, Philadelphia.

W. & T. Electric Lock.

Something new in the line of electric locks is now being put on the market by Wilkinson & Tinkham, Boston, Mass. The accompanying illustration shows the mechanism of this lock. It is considerably smaller than the usual electric lock, consequently less of the door is cut away in using it. As this lock is always locked when in circuit it is impossible for the door to be otherwise than fastened except when electric connection is completed. An advantage of this lock is that it is made reversible and can be used either for right or left hand doors. Every lock is so adjusted as to work on two cells of Leclanche battery.



W. & T. ELECTRIC LOCK.

Pruyn Electric Elevated Road.

An elevated road designed to run by electricity and to be cheap of construction yet efficient of operation has been invented by Henry S. Pruyn of Chicago. The car travels on what might be called a single track. The main truck is a third of the distance from the bottom of the car, while guide wheels steady the car, and also take the electricity from the conductor to operate the car. The motor is placed in end of the car, while the seats run longitudinally on each side of the car. This simple construction would require an elevated structure that it is believed could be built at small cost.

Leading Articles of the Electrical Weeklies During December.

THE ELECTRICAL ENGINEER.

New York's Electrical Sub-ways. Illustrated. I. II. III. IV. By Wm. Maver, Jr. Jan. 4th, 11th, 18th, 25th.

Laminated or Divided Iron and Other Metallic Masses in Electro-magnetic Apparatus. I. II. III. IV. By Thos. D. Lockwood. Illustrated. Jan. 4th, 11th, 18th, 25th.

The Exact Adjustment of Standards of Temperature Co-efficients. II. III. Illustrated. By E. G. Willyoung. Jan 4th, 11th.

The Strowger Automatic Telephone Exchange System. Illustrated. By H. M. Underwood. Jan. 4th.

The Efficiency of Alternating Plants. By Harris J. Ryan. Jan. 4th.

Maximum Speed on Electric Railways. By Chas. Steinmetz. Jan. 4th.

Commercial Success of Non-arcing Metal Lightning Arresters. By A. J. Wurts. Jan. 4th.

Storage Batteries in Central Stations. Jan. 4th.

Development of Electric Metal Working. By F. P. Royce. Jan. 4th.

An Ideal Central Power Station. I. II. Illustrated. By C. J. Field, E. J. Cook and F. Bourne. Jan. 4th, 11th.

The Statue of Liberty. By Major D. P. Heap. Illustrated. Abstract. Jan. 4th.

Scott's Sliding Scale Electric Meter. By W. B. Sisling. Illustrated. Jan. 11th.

The Field Telephone Repeater. Illustrated. Jan. 11th.

Insulated Electric Conductors. XV. XVI. XVII. By J. B. Williams, M.D. Jan. 11th, 18th, 25th.

Rotation of the Magnetic Field. By Chas. Steinmetz. Jan. 11th.

Central Station Economy. By Francis B. Crocker. Jan. 11th.

Alternate Currents of High Potential and High Frequency. I. II. III. By Nikola Tesla. Jan. 11th, 18th, 25th.

The Relative Advantages of Concentric and Double Cables. By M. E. Eden. Jan. 18th.

The Utilization of Niagara. I. II. By Prof. Geo. Forbes. Illustrated. Jan. 18th, 25th.

Provisional Program of the International Congress. Jan. 18th.

The Carbon Filament Lamp of 1859.—The Story of an Overlooked Invention. By Franklin Leonard Pope. Illustrated. Jan. 25th.

Some Mechanical and Electrical Analogies. By Frederick Bedell and A. C. Crehore. Jan. 25th.

Electric Railway and Lighting Stations, by C. A. Cooley. Jan 25th.

Experiments with High Frequency Electric Discharges. By A. A. C. Swinton. Jan. 25th.

Electrical Recording Meters. I. By Caryl D. Haskins. Jan. 25th.

Incandescent Lamp Litigation—Henry Goebel, a New Claimant for the Priority. Jan. 25th.

THE ELECTRICAL WORLD.

The Incandescent Lamp Situation. Jan. 7th.

Electrical Progress During 1892. Jan. 7th.

On Inert Gases in Incandescent Lamps. By Dr. L. K. Bohm. Jan. 7th.

The Cologne Municipal Lighting Station. I. II. Illustrated. Jan. 7th, 14th.

High vs. Low Frequency in Transformers. By Louis T. Robinson, Jan. 7th.

Regulation Test of the Ryan Special Series Motor. By W. L. Bliss. Jan. 7th.

Chronological History of Electricity. II. III. 1800 to 1820. By P. F. Mottelay. Jan. 7th, 21st.

Experimental Determination of Electrical Oscillations. Illustrated. Jan. 7th.

Electrical Progress in Germany. Jan. 7th.

Practical Primary Batteries. By C. D. Marsh. Jan. 7th.

Report of the Board of Trade Committee on Electrical Standards. Jan. 7th.

An Ideal Central Power Station. II. By C. J. Field, E. J. Cook and F. Bourne. Illustrated. Jan. 7th.

Experimental Researches on Alternate Current Transformers. II. III. IV. By Dr. J. A Fleming. Jan. 7th, 21st, 28th.

Rapid Transit. Jan 14th.

The Rock Creek Electric Railway, Washington, D. C. Illustrated. By F. G. Bolles. Jan. 14th.

Suggestions for Metering Devices. I. Illustrated. By S. D. Mott. Jan. 14th.

A New Meter for Registering for Varying Rates. Illustrated. Jan. 14th.

Applications of Electricity to Agriculture. V. Jan. 14th.

Passenger Traffic in Great Cities. Jan. 14th.

The Teaching of Science in Schools. By Henry Cunynghame. Jan. 14th.

The International Electrical Congress at Chicago. Jan. 14th.

Construction and Operation of Electric Fountains. Illustrated. Jan. 21st.

Reversibility of Three-Phase Motors with Induction Winding. By Ernst Danielson. Jan. 21st.

Electrical Needs of the Times. By H. Franklin Watts. Jan. 21st.

Recent Progress in the Introduction of the Triphase System. Illustrated. Jan. 21st.

Werner Von Siemens: Some Additional Details Regarding His Life and Work. Jan. 21st.

Calculation of a Small Electric Motor of 10 Kilogrammetres. I. By E. Meylan. Jan. 21st.

The Calculation of Alternating Current Motors. I. By E. Arnold. Illustrated. Jan. 21st.

Motors Without Counter E. M. F. Jan. 21st.

The Ewing High Frequency Alternator and Parsons' Steam Turbine. By Nikola Tesla. Jan. 21st.

Provisional Program for the International Electrical Congress. Jan. 21st.

The Tension in Ferranti Cables. By Dr. Behn Eschenburg. Jan. 21st.

Ether and Electricity. By A. Stoletow. I. Jan. 28th.

Suggestions for Metering Devices. I. By S. E. Mott. Illustrated. Jan. 28th.

Experiments in Electric and Magnetic Fields, Constant and Varying. By E. C. Rimington and Wythe Smith. Illustrated. Jan. 28th.

Experiments with High Frequency Electrical Discharges. By A. A. C. Swinton. Jan. 28th.

Electrical Recording Meters. By Caryl D. Haskins. Jan. 28th.

Some Mechanical and Electrical Analogies. By F. Bedell and A. C. Crehore Jan. 28th.

Calculation of a Small Electric Motor of Ten Kilogrammetres. By E. Meylan. Jan. 28th.

WESTERN ELECTRICIAN.

The "Booster" at the Twenty-seventh Street Edison Station, Chicago. Illustrated. Jan. 7th.

Direct Connected Gas Engine and Dynamo. Illustrated. Jan. 7th.

Keller-Degenhardt Electric Vehicle. Illustrated. Jan. 7th.

Joining Arc Light Carbon Stubs. Illustrated. Jan. 7th.

English Motor Trucks. Illustrated. Jan. 7th.

An Ideal Central Power Station. Discussion of Paper. Jan. 7th.

The Photo-electric Cells. By G. M. Minchin. Jan. 7th.

Electricity at the World's Fair. Illustrated. Jan. 7th, 14th, 21st, 28th.

Conz' Maximum Current Regulator. Jan. 14th.

Electric Railways for Summer Resorts. Jan. 14th.

Recent Improvements in Electric Locomotives, for Coal Mines. Illustrated. Jan. 14th.

Single Wire Non-insulated Telephony. Illustrated. Jan. 14th.

Electrical Development in 1892. Jan. 14th.

Locating Trouble on Arc and Power Circuits in Central Station Work. By C. O. Poole. Jan. 14th.

The Chicago Electric Club. Illustrated. Jan. 21st.

Hermite Electrolytic Bleaching Process. Illustrated. Jan. 21st.

World's Electrical Congress Program. Jan. 21st.

The Thomson Recording Watt Meter. By P. J. McFadden. Jan. 28th.

Edison Meter. By John F. Gilchrist. Jan. 28th.

Electrical Recording Meters. I. By Caryl D. Haskins. Jan. 28th.

Aron Meter. By Chas. Wirt. Jan. 28th.

ELECTRICAL REVIEW.

Improved Electro-extensometer. By Charles L. Heisler. Jan. 7th.

Mica. By C. Hanford Henderson. Jan. 7th.

An Early Comparison Between Steam Power and Electro-magnetic Power. Jan. 7th.

Letters from a Laboratory. XXVIII, XXIX, XXX, XXXI. By Julian A. Moses. Jan. 7th, 14th, 21st, 28th.

The Train Despatcher. Jan. 7th.

Electricity in the Art of War, IV. By Lieut. C. D. Parkhurst. Jan. 7th.

Mercadier's Bitelephone. Illustrated. Jan. 14th.

Hints to Owners and Operators of Light and Power Stations. By Robb Mackey. Jan. 14th.

The Police Telegraph System of the City of Brooklyn. Jan. 14th.

Electrical Patents Worth Noting. Illustrated. Jan. 14th.

Operating Polyphase Alternating Current Motors. Illustrated. Jan. 14th.

Electro-diagnosis. Jan. 14th.

Medical Electricity. By Dr. J. Mount Bleyer. Jan. 14th, 28th.

Bradley Alternating Current Motors. Illustrated. Jan. 21st.

The Transformation of Energy; Joules' Discovery. By V. E. Johnson. Jan. 21st.

Mountain's Method of Manufacturing Wire. Jan. 21st.

The Ewing High Frequency Alternator and Parsons' Steam Turbine. By Nikola Tesla. Jan 21st.

A New Method of Making Incandescent Lamp Filaments. Illustrated. Jan. 21st.

Interference of Electrical Waves, in a Metallic Circuit; Illustrated by the Telephone. Jan. 21st.

Submarine Telegraph Enterprise. Jan. 21st.

A Compact, Cheap and Powerful Magnet. Jan. 21st.

New Features of the Stanley Transformers. Illustrated. Jan. 28th.

Historical Sketch of the Storage Battery. By C. F. Uberlacher. Jan. 28th.

Some Mechanical and Electrical Analogies. Jan. 28th.

Electricity in Medicine. Jan. 28th.
An Electric Torpedo Detector. Jan. 28th.
The Development of High Speed Automatic Cut-off Engines. Illustrated. Jan. 28th.
Meeting of the Advisory Council of the Chicago Electrical Congress. Jan. 28th.
Electrical Forging of Round Shapes. Illustrated. Jan. 28th.
Electrical Recording Meters. By Caryl D. Haskins. Illustrated. Jan. 28th.
The Incandescent Lamp Situation. Jan. 28th.

THE ELECTRICAL AGE.

Micanite for Armature Insulation. II. By E. P. Thompson. Jan. 7th.
Sebold's Return Ground System for Electric Railways. Illustrated. Jan. 7th.
History of the Lamp Case. Jan. 7th.
Electric Cranes. Jan. 14th.
Important Events in 1892. Jan. 14.
Necrology in 1892. Jan. 14th.
Primary Batteries. By G. Emil Hesse. Jan. 14th.
Electrical Dental Apparatus. Illustrated. Jan. 14th.
Electricity; its Application in Dental Practice. By Albert C. Westlake. Jan. 21st.
Trial of the Storage Battery Car. Illustrated. Jan. 21st.
The Objective Representation of Hertz's Researches on Electrical Radiation. By L. Zehnder. Illustrated. Jan. 28th.
Electrical Recording Meters. By Caryl D. Haskins. Illustrated. Jan. 28th.
The International Electrical Congress. Jan. 28th.

ELECTRICITY.

Philadelphia's First Electric Railway. Illustrated. Jan 4th.
Utilizing the Forces of Nature. I II. By Nelson W. Perry. Jan. 4th, 11th.
Micanite for Armature Insulation. II. By Edward P. Thompson. Jan. 4th.
Signalling and Speaking by Means of Electrical Currents Without Wires. By Sidney F. Walker. Jan. 4th.
An Ideal Central Power Station. II. By C. J. Field, E. J. Cook, and F. Bourne. Illustrated. Jan. 4th.
A Mountain Railway. Illustrated. Jan. 11th.
An Ideal Central Power Station. Discussion of Paper. Jan. 11th.
An Electric Motor Factory. Illustrated. Jan. 18th.
World's Fair Electrical Congress. Provisional Program. Jan. 18th.
The Deflection and Control of Galvanometers. By E. Tremlett Carter. Jan. 18th.
Paris, 1881 and Chicago, 1893. By G. Emil Hesse. Jan. 18th.
Electro-Chemical Bleaching. Illustrated. Jan. 25th.
Electrical Recording Meters. By Caryl D. Haskins. Illustrated. Jan. 25th.
Some Mechanical and Electrical Analogies. By F. Bedell and A. C. Crehore. Jan. 25th.

To Calculate For Wiring.

Badly designed wiring from the transformer to the lamps often leads to variations of the candle power in the lamps that, almost without exception, is laid to poor regulation in the transformer. For the benefit of those desiring a simple formula for calculating leads for multiple distribution, Taylor, Goodhue & Ames have devised the following:

$$\text{C. M.} = \frac{21.21 \times C \times D}{E}$$

C. M. = Area of wire in circular mils. 21.21 = Constant for 2 mil feet of copper wire. C = Current in amperes. D = Distance in feet to lamps. E = Volts loss in conductor.

Financial Notes.

The General Electric Company paid a dividend of 3½ per cent on its preferred stock on January 2d.

The Eastern Electric Cable Company, Boston, has declared its regular semi-annual dividend of 3 per cent on its preferred stock.

The American Bell Telephone Company paid its regular dividend of $3 a share last month, and an extra dividend of a like amount.

The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., declared a semi-annual dividend of 3½ per cent on its preferred stock, and paid it January 3.

The Binghamton (N. Y.) Railroad Company has issued $600,000 first mortgage 5 per cent bonds to run 30 years. Of this issue, $200,000 is to retire maturing obligations; $50,000 will be retained in the treasury for future extensions, and $350,000 will be devoted to improvements and electrical equipment of lines recently leased.

ELECTRIC LIGHT AND POWER.

EXTENSIONS AND IMPROVEMENTS.

Del Norte, Colo.—The Del Norte Electric Light & Power Company will change its alternating dynamo for one of greater capacity and make other improvements. H. S. Truesdell is manager and purchasing agent.

Tarkio, Mo.—The Rankin Electric Light & Power Company wishes information in regard to meters for selling current as it proposes to make use of them. J. M. Wolfe is manager.

Tipton, Ind.—The Tipton Electric Light Company will enlarge its plant in the near future and make other improvements. A. S. Nickey is manager and purchasing agent.

Hastings, Neb.—The Hastings Electric Light & Power Company, of which H. M. Miller is manager and purchasing agent will build an entirely new plant.

Madison, Wis.—The Four Lakes Light & Power Company will enlarge its building and make other improvements. H. C. Thorn is manager and purchasing agent.

Olathe, Kan.—The Olathe Electric Light & Power Company will increase its arc lighting capacity and make other changes. William A. Ross is manager.

Jersey City, N. J.—The Jersey City Electric Light Company will add two 150-horse power boilers to its power plant. H. H. Farrier is president.

Harrison, N. J.—The Excelsior Electric Company will add new boilers and engines to its power plant. W. A. Belcher is superintendent.

Lansing, Mich.—The municipality will erect a new building and add new apparatus to its electric light plant soon. J. P. Thoman is superintendent and purchasing agent.

McPherson, Kan.—The Western Water & Electric Company will extend its incandescent circuits and make other improvements. James B. Darrah is manager and purchasing agent.

Schuyler, Neb.—The municipal plant is to be somewhat enlarged in capacity soon by an increase of its generating facilities. J. H. Pollard is superintendent and purchasing agent.

Pontiac, Ill.—H. A. Foster has purchased the electric light plant of this place and has incorporated a new company known as the Pontiac Heat, Light, Power & Telephone Company to succeed the old company.

Greenfield, Me.—The Greenfield Electric Light & Power Company will increase the capacity of its plant by installing a 1,000-light alternating dynamo, a 150-horse power engine and another boiler. O. C. Irwin is manager and purchasing agent.

Indiana, Pa.—The Indiana Electric Company will add to its plant a 1,000-light alternating dynamo and an arc dynamo. Ernest Gawthrop is manager.

Danville, Pa.—The Consumers Gas Company will add another boiler to the power plant of its electric light station. J. H. Taber is purchasing agent.

Visalia, Cal.—The Visalia Electric Light & Heat Company will extend its arc lighting circuits and increase the number of lamps. B. M. Smith is superintendent.

Denton, Tex.—The Denton Water, Light & Power Company contemplates making considerable extensions to its circuits and other improvements. D. Head is superintendent.

Dixon, Ill.—The Dixon Power & Lighting Company has just installed a 100 horse power Westinghouse generator and will build and operate power circuits. E. P. Maxwell is manager and purchasing agent.

Placerville, Cal.—The Placerville Electric Light Company is installing a 500-light incandescent plant which is to be in operation this month. J. A. Green is purchasing agent.

Windsor Locks, Conn.—The Windsor Locks Electric Light Company will install a water wheel of 175-horse power capacity. William Mather is manager and purchasing agent.

La Junta, Colo.—The La Junta Electric Company will increase its power capacity by installing an 80-horse power engine. An arc lighting plant will also be installed soon. A. G. Bentley is manager.

Pomona, Cal.—The San Antonio Light & Power Company will add to its lighting plant a 50-ton ice machine.

Morrison, Ill.—The Morrison Electric Light & Power Company which is now operating only an incandescent system will install an arc plant and build arc circuits. H. S. Green is manager and purchasing agent.

Aspen, Colo.—The Roaring Fork Electric Light & Power Company is erecting and equipping a new building for furnishing power for mining purposes. The new plant will be operated by five Pelton water wheels of 250 horse-power each.

Wilmington, Del.—The Wilmington City Electric Company has recently increased its boiler capacity to 1,400-horse power and is now building a new boiler house and making other improvements.

Cordele, Ga.—D. H. Ledbetter has purchased the plant of the Cordele Electric Light Company and will improve and extend its lighting facilities before putting the plant into operation again.

Ft. Scott, Kan.—The Ft. Scott Electric Light & Power Company contemplates utilizing its exhaust steam for purposes of heating.

Monticello, Ill.—The Monticello Electric Light Company has installed a 40 light Standard arc dynamo and is offering for sale a 30-light Wood dynamo. This company also contemplates installing a fire alarm system and wishes information on the subject. W. F. Lodge is secretary.

Paragould, Ark.—The Paragould Electric Light & Power Company contemplates increasing the capacity of its plant by installing a 100-horse power engine, a boiler, and also a 1,000-light incandescent dynamo. H. W. Jeannin is manager.

Blue Island, Ill.—The village of Blue Island contemplates adding to its electric light plant a 150-horse power engine and a 1,300-light incandescent dynamo. A. C. Barber is superintendent.

Antigo, Wis.—The Antigo Edison Electric Light Company will add to its plant a standard arc dynamo with a capacity of 40 1,200-candle power lights.

New Organizations.

Kokomo, Ind.—The Citizens Electric Light & Power Company is about to put an electric light plant into operation. W. E. Avery is manager.

Marshall, Mo.—An electric light plant is about to be established here to be in operation in March. Ernest D. Martin, the mayor, can give information.

Lexington, Mass.—The Lexington Gas Light Company is installing an electric light plant to operate both arc and incandescent circuits. R. B. Taber is manager and purchasing agent. The plant is to be in operation early in February.

Newark, Del.—A municipal plant has recently been put into operation here operating incandescent circuits. A. Homewood is superintendent and purchasing agent.

Hillsboro, Ill.—The Hillsboro Electric Light Supply Company has been chartered and will at once build a plant, or, if favorable opportunity offers, will dispose of its franchise. Contract has been made with the city for a number of arc lights for street lighting purposes.

Laurel, Md.—The Laurel Electric Light & Heat Company is building and equipping an electric light plant which is to be in operation in February. L. A. Ellis is manager and purchasing agent.

Dillon, Mont.—The Dillon General Electric Light Company has put a new electric light plant into operation since January 1st operating both arc and incandescent circuits. C. B. Wickham is manager and purchasing agent.

Cobleskill, N. Y.—An electric light plant is being installed here and is to be in operation soon.

Jonesboro, Ark.—The Jonesboro Power Company is building and equipping an electric station which will operate both arc and incandescent systems. The plant is to be in operation early in March. G. W. Decker is president and purchasing agent.

Washington, Mo.—The Washington Electric Light Plant operating both arc and incandescent systems has just been put into operation. A. A. Tibbe is owner and manager.

Marshall, Mich.—A municipal plant has just been put into operation here, operating both arc and incandescent systems.

St. Clair, Pa.—A municipal electric light plant has been put into operation here. John W. Reese is superintendent and A. T. Moore, Jr., purchasing agent.

Holly, Mich.—The Holly Electric Light & Power Company has just put its plant into operation, running both arc and incandescent circuits. Charles H. S. Poole is manager.

Medford, Wis.—T. F. M. and F. D. Shaw are just putting into operation a lighting plant operating incandescent circuits.

Mt. Carmel, Ill.—The town of Mt. Carmel is building an electric light plant, which it is hoped to have in operation in April. R. S. Gordon is mayor and can give information.

Westfield, N. Y.—The town of Westfield recently put a municipal lighting plant into operation and now contemplates extending its circuits in the early spring. J. G. Finlay is manager and purchasing agent.

Brownwood, Tex.—The Brownwood Electric Light Company proposes to install an arc lighting plant and also add motor circuits.

THE ELECTRIC RAILWAY.

EXTENSIONS AND IMPROVEMENTS.

Ottawa, Ill.—The City Electric Railway Company will construct a loop line in the town of Peru requiring about two miles of track, and will also ascend a steep grade by means of a hoist. H. Johnson is manager.

Dubuque, Ia.—The Dubuque Street Railway Company will change three miles of single track to double track, and will make other improvements. J. A. Rhomberg is president and manager.

San Jose, Cal.—The San Jose & Santa Clara Railway Company will construct between two and three miles of track in the early spring, and make other improvements. J. P. Burke is manager.

Lincoln, Neb.—The Home Street Railway Company has been organized by the consolidation of several street railway lines, and extensive improvements and extensions are in contemplation. E. Finney is manager.

Niles, O.—The Mineral Ridge & Niles Electric Street Railway Heat, Light & Power Company will extend its street railway tracks several miles by building one extension from Niles to Warren, and another from Niles to Gerard. W. T. Williams is president and manager.

New Organizations.

Ocala, Fla.—The Ocala Light & Power Company is considering constructing an electric street railway to Silver Springs, a distance of six miles. James Chambers is president, manager and purchasing agent.

Washington, Ind.—The Graham & Cox Electric Light Company, which recently put into operation an electric light plant, contemplates the building of an electric railway.

Denver, Colo.—The Denver, Lakewood & Golden Railway Company will build and equip eight miles of railway. T. E. Mitten is acting manager.

Sterling, Ill.—The Sterling & Rock Falls Interurban Railway Company has been incorporated to build six miles or more of line, the road to be completed this year. E. W. Jackson is president.

Denver, Colo.—The Denver & Westminster Railway Company has been incorporated and proposes to build about eighteen miles of electric railway. H. J. Mayham is president and manager.

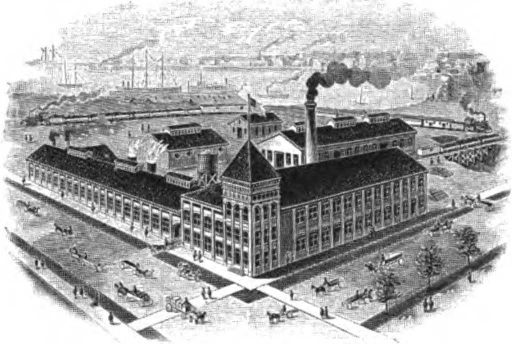
Newtonville, Mass.—The Newton & Boston Street Railway Company has put about four miles of line into operation. F. G. L. Henderson is superintendent.

South Braintree, Mass.—The Braintree Street Railway Company has been incorporated and is negotiating for the construction of its line, which will be about four and one-half miles in length. The company is now examining storage battery systems with a view to their adoption. F. A. Hobart is president.

Reorganization of the Great Western Electric Supply Company.

In the early part of the year 1889 the Great Western Electric Supply Company was doing a small jobbing business at 190-192 Fifth Ave., Chicago. The directors of the company deemed it advisable to manufacture many of their own supplies and with that end in view the company moved to 195 South Canal St., where facilities for manufacturing were obtained and work was begun with one man and two boys. The specialties manufactured proved very popular and the facilities were continually increased until it soon became necessary to move into the present large quarters, 195-207 in the same building. In less than two years the company increased its space three times and more than correspondingly branched out in the manufacture of supplies until its own specialties now include arc lamps, fixtures of all kinds, sockets, bells, push buttons, and a full line of electrical sundries.

A few months ago the Great Western Company took an interest in the Chicago Insulated Wire Company and later practically purchased all the stock of that concern and greatly extended its business until now it occupies a large building and has over 300 machines in operation. Needs for further extensions of business became pressing and arrangements have just been perfected by which the Great Western Electric Supply Company, the Chicago Insulated Wire Company, the Western Electrical Supply Company, St. Louis; the Phoenix Manufacturing Company, Duluth, Minn., and the Bain Electric Manufacturing Company, of Chicago, are all combined into one concern and the great plant of the Phoenix company will be used as the factory. The new company will be known as the Great Western Manufacturing Company. This large factory is one of the finest in the northwest and covers some four acres of ground. The Chicago factory has been transferred to Duluth and the business will all be centered there in a few weeks. The new company will do an extensive manufacturing business particularly in the lines of dynamos, motors, locomotives, electric drills, mining machinery, test instruments, fixtures, wires and a full line of supplies, and it is proposed later to add a rolling mill to reduce ingot copper from the neighboring mines for conversion into wire, rods, etc.



FACTORY OF THE GREAT WESTERN MFG. CO.

The electrical management of the new factory will be in the hands of Mr. Foree Bain who is so widely known, especially to the readers of ELECTRICAL INDUSTRIES, as a thoroughly practical as well as a theoretical electrician. The stockholders of the Great Western Electric Supply Company hold a controlling interest in the new company. Several leading men of the northwest have become interested in it. The company is incorporated with a capital of $1,500,000. The officers of the new company will be as follows: President, T. B. Casey, director in the Northwestern National Bank of Minneapolis. First vice-president, Roger S. Munger, president of the Imperial Mills Company, W. Duluth. Second vice-president, Col. C. H. Graves, president of Lake Superior Elevator Company, Duluth. Third vice-president, Hon. Stephen J. Young, president of the Union National Bank, Brunswick, Me. Treasurer and secretary, H. A. Odell, Chicago, representing Gov. W. R. Merriam, president Merchants National Bank, St. Paul, Minn. Manager, E. R. Gilman, formerly president of the Northwest Thomson-Houston Electric Company, St. Paul, Minn.

Light and Railway Matters at Monterey Cal.

Editor ELECTRICAL INDUSTRIES:—The Monterey Electric Light plant belongs to the Monterey Electric Company, but Cornell, Hopkins & Company, of San Francisco, have a franchise for a light plant at Pacific Grove and will buy out the Monterey plant. They have also bought our horse railroad paying $75,000, for it and will take possession on the first of February. Then they will turn this into an electric railroad. They intend to go to work on the power house this week. I shall probably remain as superintendent of the new road which will be about seven miles long when completed. The capital stock of the new company will be about $500,000. The officers have not been elected yet. Our rail now is twenty pound steel. We shall use about seven electric cars.

A. J. HAYNES, Superintendent.

Monterey Cal., January 1st, 1893.

Henry Electric Company's New Plant.

Editor ELECTRICAL INDUSTRIES:—We are a new company, only been running since December 31st. 1892. We commenced work December 1st and in just twenty days work we had our plant ready to run. We lost the balance of the month waiting on material and the bad weather. We have one 600-light, alternating current dynamo and one 35-light arc machine of 2,000 c. p., both Thomson-Houston machines. Our present boiler capacity is one 60 inch 16-foot horizontal tubular. We are running both dynamos in tandem from one Armington & Sims' 8½x10 engine running at 300 revolutions. We will put in a tandem compound engine of about 100-horse power soon. We have no commercial lights running yet but will have in a short time. We have not incorporated but will soon.

HENRY ELECTRIC COMPANY,
By F. O. STERRETT, Manager.

Henry Ill., January 21st, 1893.

TRADE PUBLICATIONS.

An attractively and neatly printed pamphlet descriptive of the Diamond transformer, of which Taylor, Goodhue & Ames, Chicago, are selling agents, is just from the press. In these pages is a good deal of valuable information on the subject of transformers in general, and of the Diamond transformer in particular. This instrument is described and illustrated fully, all important points being strongly brought out. Every user of the alternating current should have a copy of this pamphlet, as he would find it instructive and valuable for reference.

A neat catalogue and price list has been issued by the Campbell Electrical Supply Company, 104 High St., Boston, Mass. This company has only recently entered the electrical field, and it offers in this catalogue a list of very promising specialties, among which are the following: Century feeder wires, Century underground cables, Century mining cables; Century submarine cables, Century line wires, Century insulating tape, and Century insulating paint. These various products are fully described in this catalogue.

An instructive catalogue has been issued by the Mica Insulator Company, Schenectady, N. Y., illustrating and describing this company's insulating material, Micanite, which has attracted so much interest on account of its efficiency. This material is made of pure India sheet mica, and in adapting it to the several uses the least amount of cement of the highest resistance is used. Micanite is made for all purposes of insulation, such as commutator segments, tubes, troughs, washers, rings, cloth and paint. The catalogue describes and illustrates fully all these several uses.

Pocket Catalogue No. 6 is just at hand from the Consolidated Electric Manufacturing Company, Boston. This describes the various specialties handled by this company, including the Bibber arc lamp for incandescent circuits, hanger boards, cut outs and switches, incandescent lamp adjusters, electric bells, annunciators, electric gas lighting devices, primary batteries, fan motors, the Lyon brake for electric cars, etc. The catalogue is of convenient size, each device is illustrated with prices given, and an index at the end of the catalogue completely supplements the information given.

The bound volume of the records of the Fourteenth Convention of the National Electric Light Association, which was held at Montreal, Canada, September 7, 8, 9 and 10, 1891, has now been published and is ready for distribution. Every member of the Association, and every person interested in electric light matters, should possess one of these volumes because of its intrinsic value. Copies can be had of the secretary of the association, George F. Porter, 136 Liberty street, New York.

NEW BOOKS.

How to Make a One-Horse Power Motor or Dynamo, by A. E Watson, illustrated. Published by the Bubier Publishing Company Lynn, Mass. Price 25 cents.

In writing this little volume Mr. Watson endeavors to satisfy the cravings of many amateur and practical mechanics who are anxious to try a hand at building an electric machine. In these pages he has given full and complete instructions for building a practical high speed machine of unique construction. Innumerable diagrams are given to assist in constructing the various parts, and complete measurements make it possible to easily construct a machine by following the directions given. The matter of winding the armature is fully illustrated and described. In constructing one of these machines it will be necessary to purchase or have made many castings and other parts, and these can be supplied when desired by the Bubier Company.

Electric Lighting and Power Distribution. Part I., by W. Perren Maycock. Published by A. C. McClurg & Company, Chicago. Price, in paper, 75 cents.

This volume is intended as an elementary manual, and was originally published for the use of students intending to take examinations in the city and guilds of London Institute, London, Eng. There are 123 illustrations and diagrams, thus making the text perfectly simple and comprehensive. The six chapters are divided into the following headings: Chapter I., Force; Chapters II. and III., Electricity; Chapter IV. Induction of Currents; Chapter V., Electrical Measurements; Chapter VI., Principle of the Dynamo.

In order to keep the many architects, contractors and other users of Interior Conduit posted in regard to its use and adaptability, the Interior Conduit and Insulation Company has begun the publication of a monthly journal entitled Architects' Electrical Bulletin. Volume 1. Number 1, dated December, 1892, is just at hand, and well shows the extensive use of this conduit.

Calendars Received.

The Commercial Electric Company, Detroit, Mich., issues a calendar with a large half-tone cut illustrating its type of electric machines.

The McCreary Electrical Specialty Company. New York, announces that its calendars for 1893 are now ready for its paper weights.

The Davis Electrical Works, Springfield, Mass., issue a very attractive folder calendar printed in two colors. It is especially convenient for standing on the desk.

Alfred F. Moore, Philadelphia, issues a large office calendar, the top of which gives a brilliant effect, as it is printed in several colors of bronze, which are blended into one another.

The Central Electric Company, Chicago, issues a convenient size office calendar, on the head of which are illustrated various electrical supplies, and Okonite, with its well-known trade mark.

The Detroit Electrical Works, Detroit, Mich., sends out one of the choicest calendars of the season. The heading is a very artistic and effective lithographed landscape. The calendar part is complete, having a sheet for each month and the year's calendar for convenience of reference.

The Bubier Publishing Company, Lynn, Mass., publishes a handsome souvenir calendar of the World's Fair. The twelve sheets representing the several months contain a different half-tone picture each of a building at the Fair, and the sheets are neatly tied together with a silk cord.

The Enterprise Electric Company, Chicago, issues a calendar lithographed in color, and naturally N. I. R. wires and cables, as well as other electric supplies, are referred to. The picture represents a young woman sitting on the quarter deck of a yacht, and in the distance is the statue of Liberty.

The Pennsylvania Electric Engineering Company, Philadelphia, greets its friends with a calendar on which is an artistic female figure lightly draped, and with bow and arrow, the bow fully drawn, and a "Pennsylvania" lamp at the end of the arrow. It is a striking piece of work, neatly executed, and made effective by the red lettering telling of the apparatus this company handles.

PERSONAL.

Dr. John McKinlock has been appointed medical director in Chicago for the Commercial Alliance Life Insurance Company of New York.

Mr. L. E. Myers, special agent of the Detroit Electrical Works, has had his contract renewed in terms most highly complimentary to him, both as to the manner in which he has handled business and in the volume that he has secured.

Mr. H. W. Weller, of the New York office of the railway department of the General Electric Company, has been in charge of the railway supply house in New York, since December 1st last. Since he has had this department under his care, the results obtained have been more than satisfactory.

Mr. S. F. B. Morse of the firm of Cushing & Morse, Chicago, is co-operating with Col. Clowry and others interested in getting up an exhibit of telegraph relics for the World's Fair. Mr. Morse has in his possession some very interesting and valuable relics which belonged to his grandfather, Samuel F. B. Morse, inventor of the telegraph.

Mr. Edward Caldwell assumes the duties of editor of the *Street Railway Gazette*, having recently resigned his position as associate editor of the *Electrical World*. The wide experience of Mr. Caldwell in electrical newspaper work, together with his former connection with the Sprague Electric Railway & Motor Company, admirably fit him for the work he has in hand. It is understood that he, with friends, has secured the controlling interest in the *Gazette* and his large circle of friends and acquaintances in the west will wish him much success in his new enterprise.

BUSINESS NOTES.

The Detroit Electrical Works, have been compelled, owing to the increased business done by their western office, to take additional office and storage room in the Monadnock building, Chicago.

The Pullman Palace Car Company, Chicago, opened the new year with several good sized orders for street cars, among the larger orders being one of 46 cars for Milwaukee, and another of 20 cars for Toledo.

The Enterprise Electric Company, 307 Dearborn St., Chicago, reports business as lively. President W. C. McKinlock, of the company, has just returned from the branch house at St. Louis with some good orders.

Cushing & Morse, 225 Dearborn St., Chicago, general western agents of Day's Kerite wires and cables, report business as good and prospects bright for the coming season. A number of good sized orders have recently been secured by this firm.

The Standard Electric Company, Chicago, had on its books Jan. 1st for delivery during the month 3,150 arc lights, which is quite remarkable considering that this is the season of the year when demand for dynamos is calculated to be much smaller than at other seasons of the year.

The Stirling Company, Pullman Building, Chicago, has sold 400-horse power Stirling water tube safety boilers to the Bay City Electric Railway Company, Bay City, Mich. A second order for 600-horse power in these boilers has also been received from the Toledo Consolidated Street Railway Company, Toledo, O.

The Commercial Electric Company, Indianapolis, Ind., is now in full running order, and is receiving so many inquiries and orders for its new dynamos and motors that it has opened a Chicago office at 455 The Rookery, in charge of Fred L. Wolfram. These machines were fully described in Electrical Industries last month.

The Massachusetts Chemical Company, whose general offices are 8 Oliver St., Boston, Mass., has experienced such a trade in its Insullac and other specialties that it has been necessary to open a western office, and Harry Bishop has been appointed general western agent, with headquarters at 823 Monadnock building, Chicago.

The Crocker-Wheeler Electric Company, New York, is at work upon a new catalogue, which it will shortly issue for gratuitous distribution. The work will be finely illustrated and replete with information regarding the company's well-known and extensive line of dynamos, direct current transformers, fan motors, etc.

The Southern Electrical Supply Company, St. Louis, Mo., has experienced such an increase in the volume of its business that it has been forced to seek larger quarters, so has leased the building at No. 11 South Seventh St. With these new quarters the company will have the much needed increase to its facilities for handling business.

The Central Electric Company, 116–118 Franklin St., Chicago, has secured several new and promising specialties which it will put on the market as soon as it perfects arrangements for increased facilities. This company's working force has been considerably increased, so that it is now in a position to handle any volume of trade.

The Knapp Electrical Works, Chicago, have just secured an order for two car loads of No. 0000 feeder wire from the Duluth Street Railway Company. With its present stock of wires, this company is in position to ship at once almost any quantity of any size of weatherproof or underwriters' wire, or any size of magnet wire, single or double covered.

The Electrical Installation Company has just been organized and will have offices in the Monadnock building, Chicago. This company will devote itself exclusively to contracting for the overhead construction of electric railways; also for the construction of lighting plants, etc. The company is a strong organization and gives promise of being a very active factor in the electrical construction field.

The Ball Engine Company, Erie, Pa., reports large sales through its eastern agent, Frank R. Chinnock, 18 Cortlandt St., New York. The following are among the recent orders filled: Buffalo North Main & Tonawanda Street Railway Company, Tonawanda, N. Y.; Ithaca Street Railway Company, Ithaca, N. Y.; Seabury & Johnson, East Orange, N. J.; Hahne & Co., Newark, N. J.; Dows Stores, Brooklyn, N. Y.

The W. S. Edwards Manufacturing Company, 86 and 88 West Lake St., Chicago, manufacturer of gas and electric light fixtures, is remodeling the five-story and basement building at 21 and 23 East Lake street, and will remove its offices and factory into these commodious quarters on or about March 1st next. As the new plant will contain nearly two acres of floor space, the company will have ample room for increasing trade. The new place will be a model in its line.

The Joseph Dixon Crucible Company, Jersey City, are putting a fifth story, 175x75 feet, on its pencil factory. Besides this large addition to the pencil factory, the company will establish a rubber and brass plant for the manufacture of the various pencil accessories and novelties. As it was only in 1891 when the Dixon company put extensive additions on its crucible and black-lead works, and erected offices which for size and beauty are second to none in the state, it is very evident that prosperity claims the Dixon company for its own.

Queen & Co., incorporated, Philadelphia, are congratulating themselves upon the increasing demand for their "Magnetic Vane" ammeters and voltmeters, as evidenced by the fact that more than twice as many of these instruments was sold by them in 1892 than in the preceding year. They are adapted for constant switchboard use, and voltmeters as well as ammeters can be left in circuit constantly. Descriptive circular No. 420 recently issued by Queen & Co. contains further information of value, and will be mailed upon application.

The Central Electric Company, 116–118 Franklin street, Chicago, has been introducing a great deal of Interior Conduit in large buildings recently in all the western cities. Three recent large contracts in Chicago were the Newberry Library building, the Athletic Club, and Congress Hall. The Lundell motors of small capacity from a fraction of a horse power to five-horse power, which were recently illustrated in these columns, and for which the Central company is agent, are meeting with ready sale throughout the territory controlled by the Central company.

The Railway Equipment Company, Pullman building, Chicago, is about to issue a new and very complete catalogue, showing all the material of its manufacture and sale and also containing valuable information of interest to all connected with electric railways. Great preparations are being made by the Equipment Company for the coming season's trade. The satisfaction found in the use of the Type G. material, made only by this company, insures a largely increased trade for the spring. General Manager Mason states that prompt shipments will be made in the future, the company having increased its facilities.

The Card Motor & Dynamo Company, Cincinnati, is crowded to the fullest extent of its capacity in the manufacture of dynamos and motors. Work on the new factory which the company started to build some time since has been interrupted owing to the severe weather but the foundations are all laid and as soon as the weather will permit work will be pushed forward to completion as fast as possible. This factory when finished will be one of the finest and best arranged in the country as no pains will be spared in its construction. The officers of the company are for the present located at 59 West Fourth St., in the Fosdick building, but will be removed to the works as soon as the building is completed.

The Railway Equipment Company, Pullman building, Chicago, held the annual meeting of its stockholders Tuesday, January 17th, and the report of General Manager W. R. Mason showed a most satisfactory state of affairs. The business of the company has been greatly in excess of expectations, and is daily increasing. The late devices brought out by the company have had an unprecedented sale, and are being adopted throughout the entire country. Mr. Mason called attention to the need of further increasing the manufacturing facilities. We understand that a very prominent capitalist has become interested in the company with the intention of still further increasing the business of this company.

The Electric Appliance Company, 242 Madison street, Chicago, is wiring many of the large buildings now going up in Chicago with Paranite wire, the latest orders being for the Gault House and the Briggs House. In anticipation of a large demand for fan motors this summer, the Appliance company is already laying in a full stock of the well-known Meston motors made by the Emerson Electric Manufacturing Company, St. Louis. The New England double pole switch has secured such a hold on the market that its manufacturers have concluded to enlarge their facilities for turning out goods and to reduce the price. In anticipation of a big business the Appliance company has laid in a full stock of these devices.

Queen & Company Incorporated is one of the recent business changes of special interest to the electrical fraternity. It is the transferring of the business of James W. Queen & Co. to a stock corporation bearing the above title. The new company starts with a paid up capital of $600,000, which will be increased from time to time as may be required for the extension of its numerous interests, which in addition to electrical measuring instruments comprise scientific apparatus of every description. The incorporators and directors for 1893 are: S. L. Fox, B. B. Fox, J. G. Gray, W. Biddle, jr., J. G. Biddle and F. W. Stanwood, all of whom have been actively connected with the old firm. E. G. Willyoung continues as superintendent of the electrical laboratory.

Stilwell-Bierce-Smith-Vaile Company, Dayton, O., is the title of the consolidated interests of two well-known firms of that city. By means of this consolidation the company is given a very large paid-up capital, and two of the finest manufacturing plants in the country. In order to facilitate the sales of the products of these two concerns the new company has opened up at 63 South Canal St., Chicago, a large sales department and warehouse, where it will carry a large stock of goods and a full line of repairs. Among recent contracts made by this company was a most important one made with the Portland General Electric Company, Portland, Ore., for twenty-two cylinder gate turbines aggregating about 7,000-horse power. It is understood that the contract involves in round numbers $150,000.

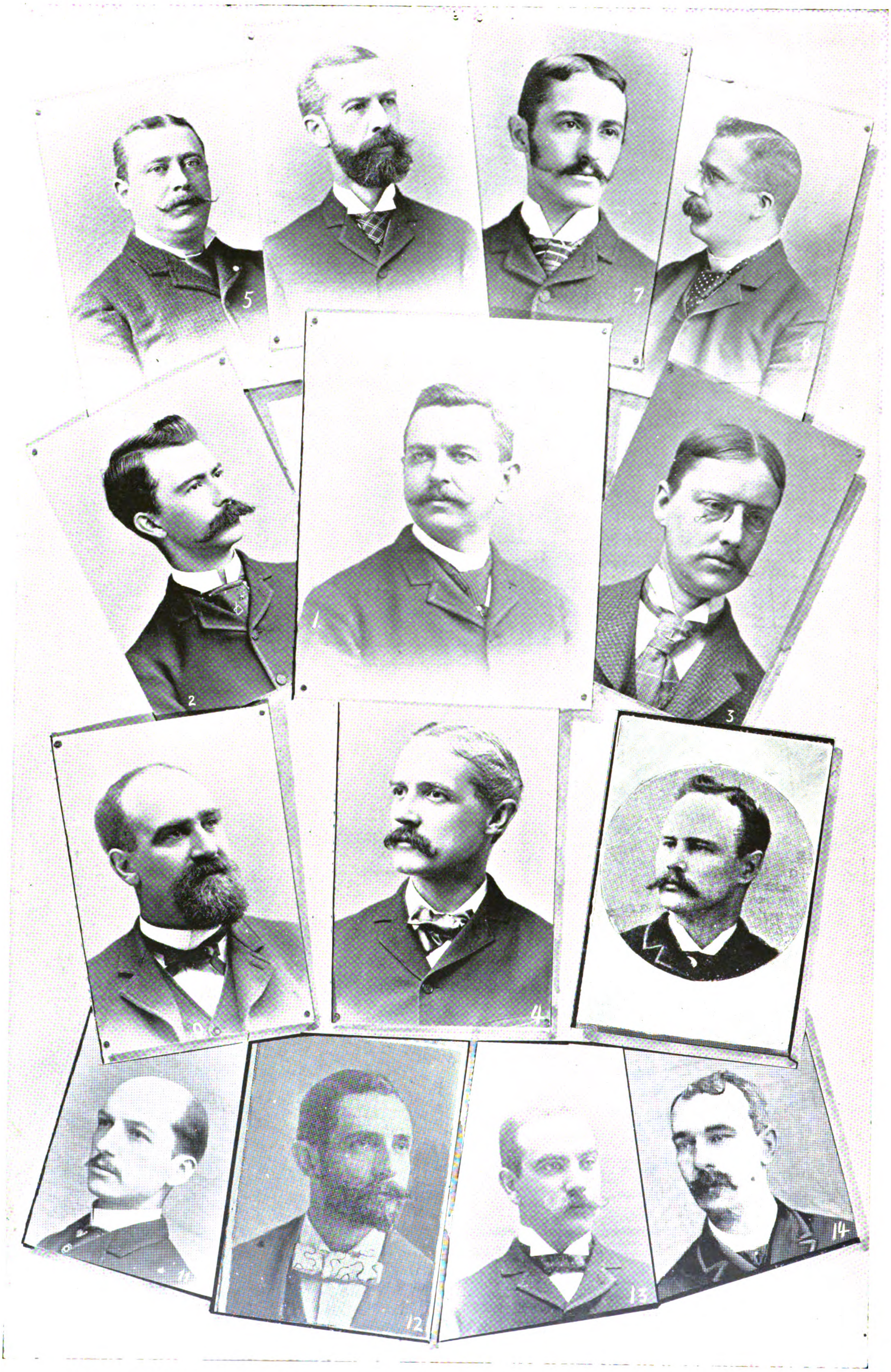
The Shultz Belting Company, St. Louis, Mo., had an exhibit of manufactured belting at the St. Louis Exposition, and the following incident is the result of a visit to that institution by one of the pupils of the Divoll school: A teacher in the Divoll Kindergarten was giving her pupils a little instruction in astronomy and the movements of the planets in the solar system, and said to a little boy: "Johnnie, what causes the earth and moon to spin on their axes like a top as they do?" "That there strap," answered Johnnie. "What strap do you mean?" inquired the mystified teacher. "Why,'m" said Johnnie, "I seen on one of them picture cards down at the Exposition, of that company what had that machine what chops pieces of leather up into little squares, a picture of a strap running around the earth and moon, making them spin around like a top."

The Electrical Supply Company, corner Michigan Ave. and Randolph St., Chicago, manufactures the Wirt dynamo brush, one of the most successful devices that has ever been offered to remedy the disastrous tendency to spark and cut at the commutator. Hundreds of sets are in use by central stations and isolated plants, and from every one comes expressions of delighted surprise at the good results obtained. There is nothing that an engineer admires more than a quiet, smooth running commutator. It means to him a relief from one of the most serious and annoying defects or evils of the dynamo room. The Electrical Supply Company manufactures these brushes in all sizes to fit any brush holder. Among the other specialties of this same company is Habirshaw wire for which it is the general western agent. Habirshaw rubber covered wire has long been recognized as standard insulation, and has been used in many of the most important buildings erected during the past year. It is also extensively used by the United States Government. The factory of Messrs. Fraser & Chalmers, an account of which we give on another page, was wired with Habirshaw.

The Electrical Agency of G. P. Altenberg.

The W. D. Graves Electrical & Manufacturing Company, Cleveland, O., has recently increased its capital from $25,000 to $75,000 because of the large increase in its business since the sales department has been transferred to G. P. Altenberg, at Cincinnati. The business of the company has been increased to such an extent that it is now manufacturing each month more arc lamps than were manufactured during twelve months before. Lamps are now being shipped to nearly every state and territory in this country; the patrons of the lamp extending from the Atlantic to the Pacific coast, and from the Lakes to the Gulf, and seventy-five electric light and railway companies have, within the last sixty days, adopted the Graves arc lamp. The company is now working its factory twenty-three hours out of every twenty-four.

The company has recently procured a new building, where it is equipping a large and complete factory to take care of its rapidly increasing business. Mr. Altenberg will bring out an arc light system on the same lines that arc lighting is done in Europe; that is, direct current generators burning lamps in multiple or multiple series. Mr. Altenberg is also agent for the National Electric Manufacturing Company, and has during the last eight months sold eighteen complete light and power plants, using 42 dynamos, having an aggregate capacity of 760-horse power in motors and generators, 180 arc lights and 4,500 incandescent lights.



PRESENT OFFICERS AND EXECUTIVE COMMITTEE OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

1 JAS. I. AYER, Pres.
2 E. A. ARMSTRONG, 1st Vice-Pres.
3 C. H. WILMERDING, 2d Vice-Pres.
4 GEO. F. PORTER, Sec'y.
5 C. O. BAKER, Master of Trans.
6 H. H. FAIRBANKS.
7 E. F. PECK.
8 FREDERICK NICHOLLS.
9 CHAS. R. FABEN, JR.
10 A. M. YOUNG.
11 ROBB MACKIE.
12 JOHN SEELY.
13 C. LEE ABELL.
14 M. D. LAW.

ELECTRICAL INDUSTRIES.

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ORGANIZATION AND FIRST MEETING —OF THE— NATIONAL ELECTRIC LIGHT ASSOCIATION.

The preliminary meeting at which the National Electric Light Association was organized was held in Chicago, Feb. 25th, 1885. The call that had been issued and from which this meeting resulted was sent out for the purpose of perfecting an organization which should meet to discuss the manner of operating plants rather than manner of installing them. Mr. William A. Hovey who called the meeting to order well stated the case when he said it was not to discuss the relative merits of different lamps and the different electrical systems. They could stand and fall by their own merits. Some lighting plants operating certain systems and using certain lamps were successful from a financial standpoint, while other stations operating the same system and with conditions practically the same were not paying expenses. It was evident that the difficulty lay in understanding how to best operate the plant, and it was for the purpose of calling managers of lighting stations together and comparing notes upon the best methods of working, the meeting was called. It would be quite impossible for a manager to go into an electric light station whether it was good, bad, or indifferent, without learning something. If this were true with one station it would be greatly more so at a convention of managers from all parts of the country.

It is interesting to read the official report of the discussions had at this meeting and to see how little information or knowledge regarding electrical matters managers of some of the pioneer stations in the field had. Many names appear in the report of this first meeting which are still familiar to members of the association, and the discussions which took place at this first convention seem very freshman-like when compared to the discussions that take place at the conventions now.

The first question discussed was in regard to the difficulty of stringing the wires of electric light or electric railway companies and telephone companies near each other. Of course at this time the telephone companies claimed monopoly of whatever streets or byways in which they had strung their wires. One instance was reported where an electric light wire came in contact with a telephone wire and as a result flames ten feet long shot out from the telephone and transmitter threatening dire destruction to all life and property. Other less fantastic stories were told of similar experiences, and the members of the convention endeavored to decide as to the best means of protecting the telephone circuits and at the same time not bear down unjustly on either the light and telephone companies. Induction and induced currents were fully discussed with interesting results, one member reporting one result under certain conditions while another reported exactly the opposite results under apparently the same conditions. One member suggested the use of a lightning arrester to protect the circuits; another one suggested the use of a fusible block; and still another the use of a third wire, one positive and two negative. After a very lengthy discussion the matter was left to a committee of three to report upon. This committee reported as follows:

> "First, that the telephone companies be encouraged to run their lines with metallic circuits.
>
> Second, that the return electric light circuit be on the same poles as the outgoing circuit, when possible.
>
> Third, that all possible care be taken to keep the electric light line carefully insulated, and all joints soldered.
>
> Fourth, that the electric light wires be suspended below the telephone wires.
>
> Fifth, that the telephone companies be recommended to use a cable with an induction-killer.
>
> Sixth, that the use of lightning arresters be recommended to telephone companies."

This probably was the first formal consideration of the trouble between electrical companies and telephone companies. Since this time the courts have not given the liberal construction of the difficulty that telephone companies claimed for themselves, and while the subject has been practically settled in this country, in the English courts the whole subject is still in the preliminary stage.

The next subject that was brought up and discussed was that of generating electricity by water power. Several managers of stations reported as to the use of water the same difficulty that has been experienced at all times, that is regulation. A few instances were reported that excited the envy of members, one member saying that it cost him $2.50 a month to light a 10-lamp circuit, including interest on the investment.

In all the discussions it was made quite evident that there was difficulty to secure efficient devices of most kinds, and many complaints were made because of this. This was especially apparent in considering the best modes of connecting dynamos with power. Some members believed that direct belting and using small units of power was the only method to secure efficiency and economy. Others had tried shafting and countershafting, and reported much success; while still other members declared that these devices could not be used and a station make any money. The general trend of the discussion was that shafting would soon be a thing of the past. In a few instances what were then large units of power were reported as working efficiently but with a minimum amount of shafting. Friction clutches seemed in most instances to be a failure.

Mr. Van Depoele brought up the matter of using electricity as a means of transmitting power. This was a subject upon which the members were all seeking information, and when the speaker stated that he believed it would be economy, especially where small units of power were required such as a few horse power, electric motors would soon be very generally used, especially in the large cities. The members took up the discussion, some of them seeming to consider such a condition of things as only a dream of distant future possibility. One member was anxious to know if there was any method of governing an electric motor. Another query was whether it was possible to run two or more electric motors from one dynamo. The discussion naturally drifted to the possible use of electricity in railways, and reference was made to an experimental road then in operation in Cleveland, constructed on the Bentley-Knight system. The motors used on these cars were of 7-horse power, and the loss of energy was reported as between 30 and 40 per cent. Surprise was expressed when it was learned that the motor used for this purpose was constructed practically the same as an ordinary motor. The question was asked with much earnestness as to whether two cars could be run in opposite directions at the same time.

The subject of insulation was one with which much trouble was reported, and some amusing instances were cited by members of their efforts to insulate their wires. One member was in much distress because of futile efforts to insulate a wire in a room where humidity was excessive and the changes in temperature very variable. In one experiment he had conducted the wire through an iron pipe, and then filled the pipe with melted resin. When the temperature went up the resin melted, and there was trouble. Then the wire was led through lead pipes, but moisture gathered in the pipe, and as the insulation was not high there was more trouble. The wire was then drawn through a gas pipe and melted paraffine poured in. The temperature of the room rose, the paraffine melted, and it was time for another experiment. This time what was called paraffine wire was used. In bending the wire to make a curve the insulation was unwittingly broken, and again the moisture got in its fine work. Several members reported trouble with insulation especially threatening to cause fire when there was wood work adjoining, and a great deal of trouble was reported from poor work among wiremen.

Some discussion was had as to whether armatures become affected by frost when exposed in transportation, and also in regard to incandescent lighting, particularly as to the length of circuit upon which it could be run with profit. This latter question was intelligently discussed by Mr. Sperry and by Mr. Van Depoele.

At the time of this convention the electric light tower was a great fad, and the popularity of this fad became very evident when discussion came on the subject, "Street Lighting; the Best Manner and Modes of Accomplishment, Location of Lights, etc." Several cities were described as very efficiently lighted by towers and results obtained from them were described in glowing terms especially in Detroit, which at that time had ninety towers with 360 lights. It would be interesting to know how many towers there now are in the various cities which were supposed to be so well lighted. The popular fear that arc lamps hung at street intersections and from poles might fall and do much damage on account of the high tension current was reflected in many of the members, and some of them described the various ways resorted to, to overcome this danger. One device that was quite elaborately described consisted of a sort of iron ladder in the form of an arch, which extended across the street corners diagonally, and in order to trim the lamp the trimmer climbed up this ladder to the top of the arch.

It is without parallel in history that such crude devices and crude notions as were prevalent at the time of the holding of this convention, as this brief review shows, should reach such a high state of perfection as they since have.

This first convention was attended by seventy-seven men, thirty-four of whom were from Chicago, and the rest from all parts of the country, including New York, Baltimore, St. Louis, Cleveland, Boston, Providence, Omaha, Dubuque and St. Paul.

Among those who took more important part in organizing the convention and in encouraging discussions were the following: Prof. Elisha Gray, Elmer A. Sperry, C. J. Van Depoele, George S. Bowen, Charles A. Brown, J. Frank Morrison, E. R. Weeks, C. C. Haskins, George D. Fletcher, W. M. Goldthwaite, George H. Wardsworth, A. L. Ide, J. H. Yarborough, G. Donaldson, C. C. Curtis, W. Hochhausen.

SOME of the bills that have been presented to the Illinois state legislature this session, would look as though an effort were on foot to cripple the industries of the state, particularly those with which electricity is connected. Besides the bill to encourage the building of municipal lighting plants and which are to be permitted to sell electricity, which has previously been referred to in these columns, an effort has been made to regulate, and in many cases reduce street car fares. Now a bill has been offered which proposes to require electric companies "to cause their wires to be insulated in such a way as to protect the public," and local authorities are to be compelled to have electric wires inspected by a competent inspector every twenty-four hours. If, through failure to comply with these requirements, a person is killed, damages may be recoverable, not to exceed $100,000.

The supreme court of Pennsylvania decides that cable and electric cars have rights which must be respected. An electric car in Pittsburg ran down a team that was unloading before a business house, and suit was brought for damages. In handing down decision, the court held that rapid transit is a necessity, and that conditions have changed since the time of the omnibus and horse car. Business prosperity of a community demands rapid transit, hence the use of the streets for the transaction of business is of necessity limited, particularly when it interferes with rapid transit.

Dr. Cornelius Herz, who is accused of complicity in the Panama scandal in France, and who fled the country but was put under arrest in England, is an honorary member of the National Electric Light Association.

St. Louis Merchants' Bridge, about two miles above the St. Louis and East St. Louis bridge, is soon to be widened for a wagon and footway and space for an electric car line on either side of the main structure.

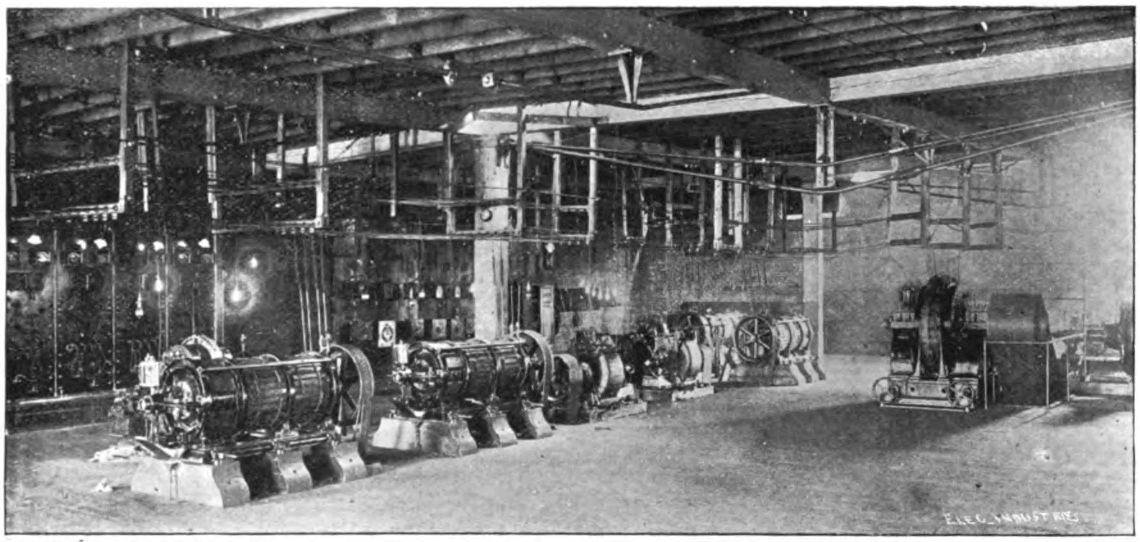
THE STATIONS
OF THE
ELECTRIC LIGHT COMPANIES OF ST. LOUIS.

In view of the holding of the convention of the National Electric Light Association in St. Louis, Mo., February 28th to March 3rd inclusive, a succinct review of that city's electric industries will be apropos.

Prior to 1880 very little had been accomplished. A few arc lights had been put in operation by enterprising individuals with varying success, but in the course of this year the Brush and Thomson-Houston central stations for arc lighting only were put into operation, the two companies being entirely independent ones.

In 1884 the Excelsior arc light central station was ready to supply lamps, and in 1886 the Western Electric system was introduced, the latter commencing with 60 and during the year increasing its capacity to 300 lamps. Previous to the advent of the low tension Western electric system, all arc lighting had been accomplished with high tension apparatus. In 1887 a consolidation of all the arc lighting companies took place, and in order to operate with less expense all apparatus was removed to the Execlsior's quarters.

In 1884 Charles Heisler introduced a system of series incandescent lighting which bears his name to this day, operating at first 200-light generator capacity, but increasing to 1,500-lights capacity in 1887. During this year the first Westinghouse alternating apparatus was put to commercial use. Though the man who introduced it did only a very small business, and that merely as an elaborate experiment, he certainly laid the foundation of what has since proven itself to be a great industry. Those interested in the Excelsior arc light station, feeling the experiments made with the Westinghouse apparatus to be of more than passing moment, purchased and introduced here larger transforming machinery, using a 1,300-light 1,000-volt dynamo, and doing legitimate lighting in 1888 from their circuits. Although nothing extensive was accomplished by these enterprising individuals, they demonstrated that incandescent lighting could be successfully and permanently done by converters. But it remained for the Missouri Electric Light & Power Company to fully develop the incandescent business. At the same time it put into constant practical operation the first central station for strictly incandescent work, using exclusively the Westinghouse alternating generators and transformers, beginning in January, 1889, with 75 lights, and reaching an output of 10,000 lamps in less than a year. During this year they obtained the contract for lighting the alleys, parks and public buildings in the southern part of the city, which again increased their capacity by 5,000 lights, and its progress has since been phenomenal. Today its total output is 80,000 lamps, varying in candle-power from 10 to 100 lighting most of the leading hotels, office buildings, clubs and churches; all the theaters, and at least 1,000 residences. The Missouri company is strictly a St. Louis enterprise. Its board of directors are all representative men and prominent business men, and they have invested only St. Louis money; no wonder then this company should be counted among the most substantial institutions of St. Louis, carrying as it does the aforementioned record.



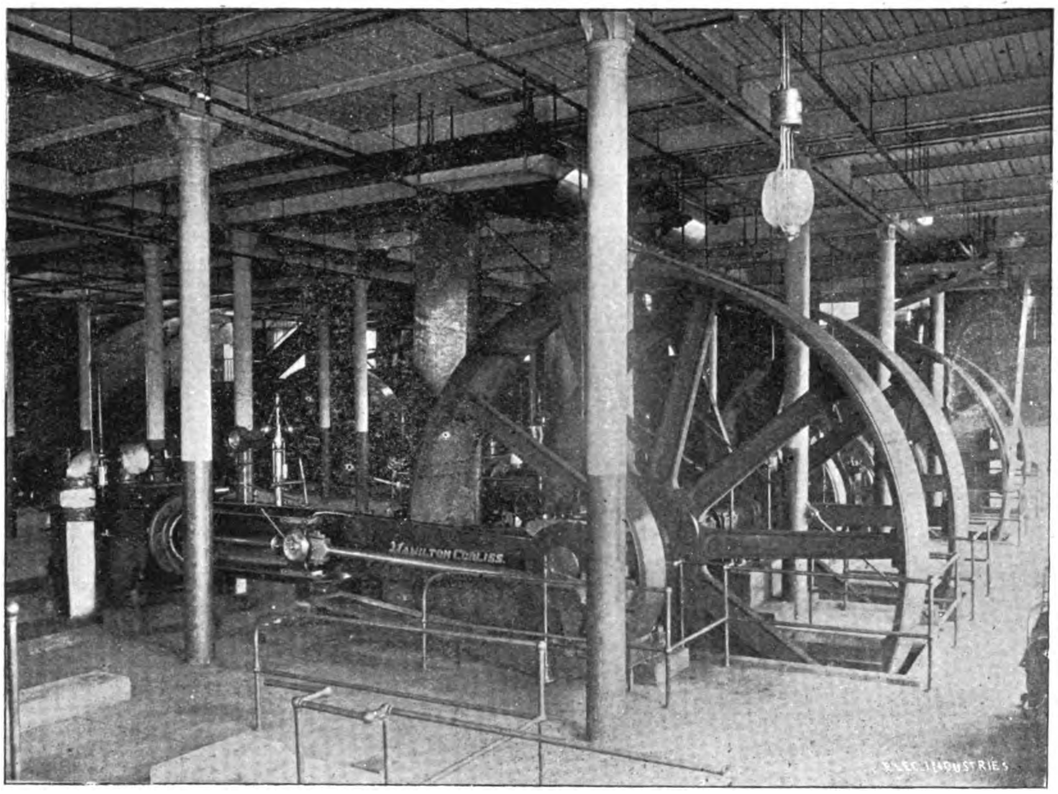
DYNAMO ROOM OF THE LACLEDE GAS LIGHT COMPANY.

This company has within the past few weeks demonstrated their ability to compete with arc lighting companies if found necessary. It has in daily use several 2,000-candle power arc lamps operated from the regular alternating incandescent circuits charging for consumption of current by meter measurement.

The electric department of the Laclede Gas Light Company was organized in 1890 to do an incandescent business, securing the contract from the city to light the public buildings, parks and alleys in the northern district. Although it has not made as brilliant a record as the Missouri company, still it has accomplished a great deal when the geography of its territory is taken into consideration. This department operates Brush alternating apparatus, together with the Heisler series system.

The Municipal Electric Lighting & Power Company was organized in 1889, having secured the city contract for both the southern and northern districts for 2,100-2,000-candle power arc lamps. A model plant was built and put in operation in 1890. This company does also a extensive business in commercial arc lighting, operating 11,500-2,000 candle-power lamps, having purchased the old consolidated companies, practically giving it control of the arc lighting of St. Louis. The total capacity of 3,600 lamps has but one source of supply, being operated by 66 circuits from the main plant at 19th and Gratiot Sts.

Some constant current motors were in service from the commencement, and such were operated up to 1891-2, when a 500-volt motor circuit was put in operation, and considerable business is being done on this. It was about the same time that this company installed an alternating incandescent plant, believing that there was ample room for three companies in that branch. As an evidence of how St. Louisians appreciate the service given by the Municipal company it has in operation on this 500-volt motor circuit 250-horse power and another incandescent circuit consumers of 20,000 lamps.



ENGINE ROOM OF THE MUNICIPAL ELECTRIC LIGHT AND POWER COMPANY.

In 1891 The Carondelet Electric Light & Power Company was organized and is today doing a very flattering business in that territory, using the Thomson-Houston alternating incandescent system. Although a young company it has a remarkable record. It operates some 2,500 incandescent lamps and is at present increasing its capacity.

So much for the lighting. In 1888 the St. Louis Electric Light & Power Company sprang into existence. Notices could be seen on every telegraph pole, stable and barn door—in fact in every available spot—announcing that this company could furnish electric power in quantities to suit the purchaser in any locality at less cost than steam could be obtained for. The two proprietors of this company were veritably the pioneers of electric motor service in St. Louis. They installed a 220-volt plant and catered for small motor work and their efforts have been rewarded. Shrewd and energetic business men, were not long in seeing the vast advantages afforded by the use of electricity for motive power service. As a consequence the St. Louis Electric Light & Power Company were soon compelled to seek more commodious quarters with a flattering business already accomplished and bright prospects ahead. It started out with a 7½-horse power Sprague motor. Today it has dependent on its stations fully 150 patrons using an aggregate of 750-horse power in motors ranging from ½ to 25-horse power. But as yet large size motors had not been put in practical operation here at any considerable distance from the supply station. To fulfill this mission the Laclede Power Company of St. Louis, came forward, first seeing the light of day in November 1890. Certainly, the working officers of this company were the first people to indisputably set forth the practicability of using large motors at long range, and it has been recognized by a long list of patrons using an aggregate of 1,000-horse power in motors on its circuits, one establishment using 75-horse power alone. The sizes of motors operated by the Laclede company range from ⅛ to 40-horse power.

The St. Louis Electric Light & Power Company has recently gone into the arc lighting business, putting in the most modern and advantageous system and operating in a field unexplored by any of the other companies.

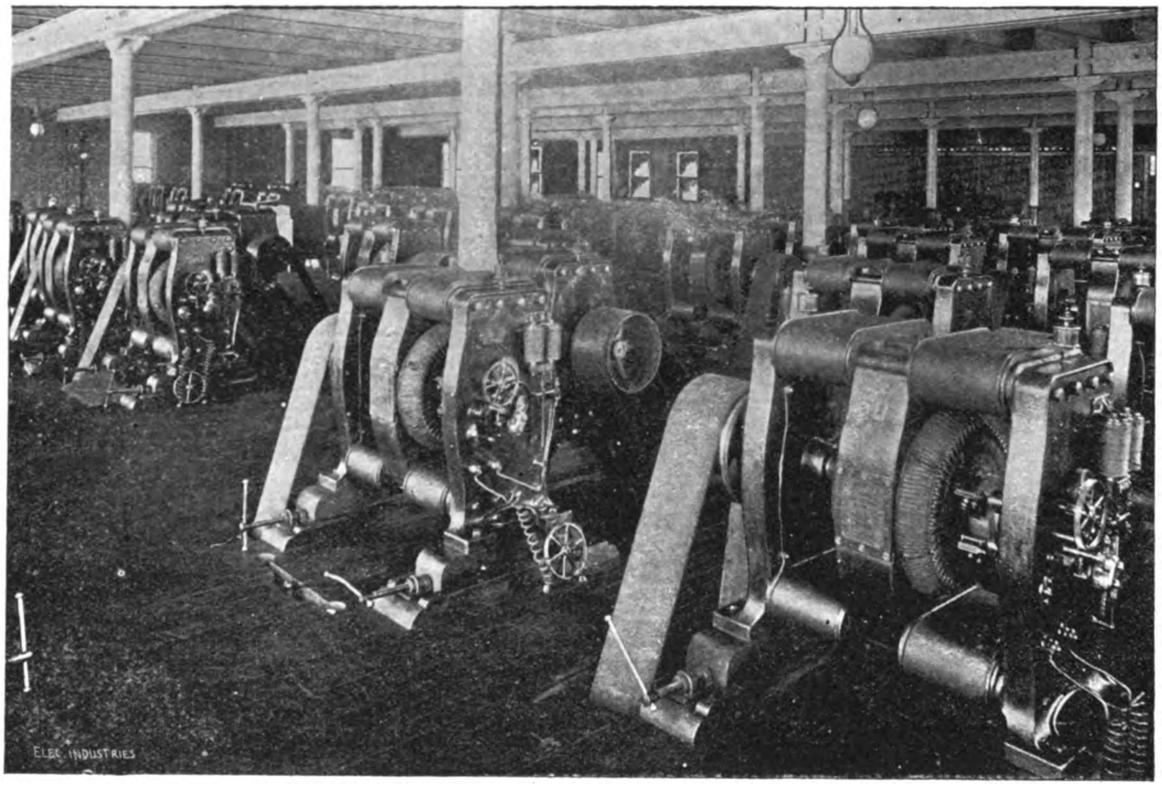
Thus it transpires that St. Louis has grown from merely an experimental electrical center in 1880 with a capacity of not more than 100 arc lamps, to be one of the most interesting and industrial cities in 1893, having a capacity of 4,000 arc lamps, 115,000 incandescent lamps and 2,000-horse power in stationary electric motors, boasting also of possessing probably the largest and best equipped arc light and alternating central stations to be found on this continent and, in addition, the two largest power central stations for stationary motors. And all this witho mention of a very potent industry, viz., street railways. Three years ago all the street cars were operated by cable, horses or mules. Today there are eight roads in actual daily operation by electricity comprising a mileage of 500 miles, and there are three other extensive roads being re-constructed intending to use also this agent.

The officers of the various companies doing business, as enumerated below, extend through us to members of the National Electric Light Association and their visiting friends a cordial invitation to visit their plants and assure them a hearty welcome.

The following are brief descriptions of the principal light and power plants at present in operation in St. Louis: Missouri Electric Light & Power Company, S. M. Dodd, president; S. B. Pike, secretary and treasurer and H. A. Wagner, superintendent. Organized January 1889. Executive offices, American Central building, Plant, 20th and Locust Sts. It has the following machinery and apparatus: Fourteen Babcock and Wilcox boilers, 250-horse power each, at 140 lbs. pressure; three No. 16 Hooker pumps; four Berryman feed water heaters of 1,250-horse power capacity; nine Westinghouse compound engines, 250-horse power each; two Westinghouse compound engines, 500-horse power each; two Westinghouse exciter engines 35-horse power each; nine Westinghouse No. 3 generators, capacity each 4,000, 16-candle power lamps; two Westinghouse No. 4, generators, capacity each 6,000, 16-candle power. It operates 700 miles of circuits upon which depend 80,000 lamps made up as follows: Commercial 50,000, residence 25,000 and city 5,000. Rates by meter per lamp have for commercial lighting one cent, residence use 1¼ cents per 16-candle power. Alternating apparatus is used entirely. Longest circuit four miles.

Electric department of the Laclede Gas Light Company. E. McMillen, president; A. Ross, general manager and secretary; T. G. Schlosser, superintendent. Organized January, 1890. Executive office: 411 West Eleventh St., Plant, Mount St. and Levee. It has as follows: Three Heine boilers, 314-horse power each, at 150 pounds steam pressure; one Deane jet condenser 500-horse power; one Wheeler surface condenser, 500-horse power; two Williams compound condensing engines, 250-horse power each; one Buckeye compound condensing engine, 350-horse power; one Buckeye ordinary condensing engine, 150-horse power; two Armington & Sims compound condensing engine, 350-horse power each; three Brush generators, capacity of each, 1200,16-candle power lamps; one Brush generator, capacity 650 16-candle power lamps; two Brush generators, capacity of each, 3000,16-candle power lamps; four Heisler generators, capacity of each, 900,32-candle power lamps. It operates 150 miles of circuit upon which depend the following lights: City, 600; residence, 2,000; commercial, 7,000; alley (Heisler), 1,100. Rates per 16-candle power lamp hour, same as Missouri company. All alternating apparatus transforming down from 2,000 to 100 volts. Largest circuit, 3½ miles.

The Municipal Electric Lighting & Power Company. Incorporated in June, 1889. President, R. T. McDonald, Ft. Wayne, Ind.; vice-president, James Campbell; secretary, John G. Kelly; General Manager, James I. Ayer. Executive offices, 504 North Fourth St. Main plant, Nineteenth and Gratiot Sts. Power plant, 212 Gratiot St. It has as follows: Nineteen tubular boilers of 300-horse power each, at 100 pounds steam pressure; six 600-horse power Hamilton-Corliss engines; one 750-horse power Hamilton-Corliss engine; sixty-three 60-light 2000-candle power arc dynamos; ten 80-light, 2000-candle power arc dynamos; two 75-light, 1200-candle power arc dynamos; five 3000-light, alternating dynamos. Power station: Five horizon-

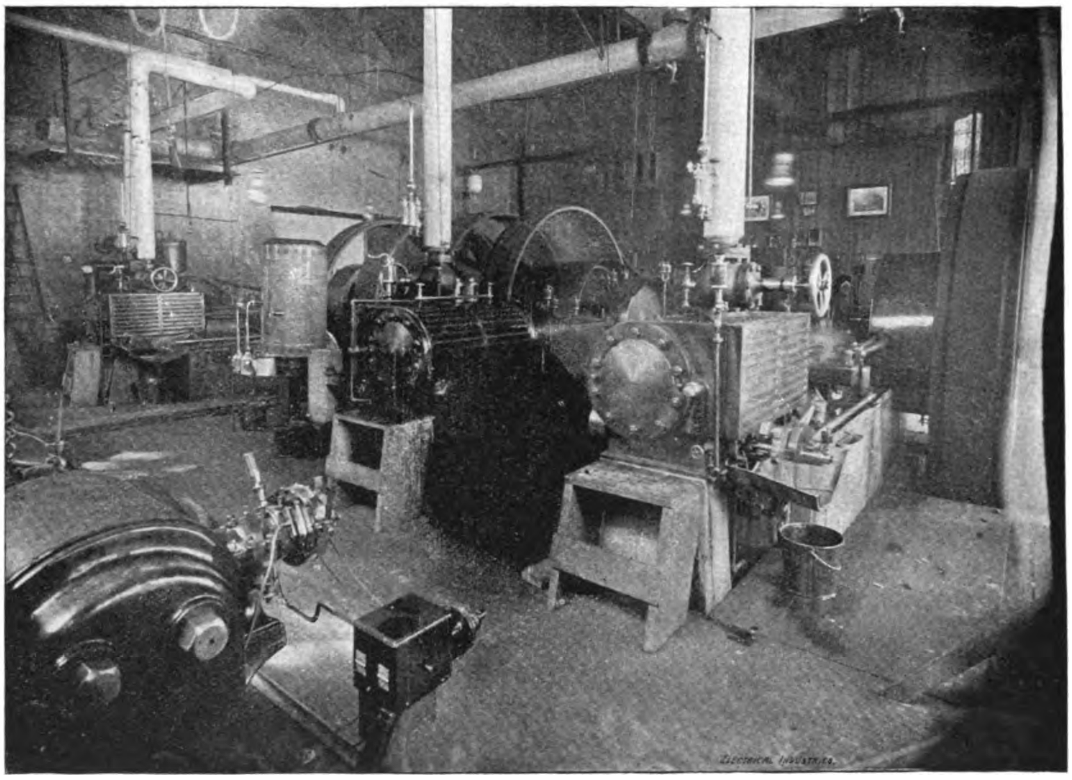


DYNAMO ROOM OF THE MUNICIPAL ELECTRIC LIGHT AND POWER COMPANY.

tal tubular boilers, 80-horse power each; three 14x20 Russell engines; one 12x14 Buckeye engine; one 120 K.W., 500-volt generator; one 80 K.W. 500-volt generator; one 30 K. W. 500-volt generator.

There are 36 city arc light circuits, measuring 532 miles, averaging fifteen miles per circuit, lengths of circuits ranging from eight to twenty-two miles, covering an area of sixty square miles, and connected to 2,100 arc lamps. There are thirty commercial arc light circuits, aggregating 240 miles of wire, connected to 1,500 arc lamps, and covering the down town district.

The alternating incandescent circuits contain about 600 miles of wire, sizes ranging from No. 8 to 0000, wired up to 20,000 16-candle power lamps, covering an area of thirty square miles. One 0000 feeder extends twelve miles to Webster Grove, and lights up the principal suburban residence district. The 500-volt motor circuits contain about twenty miles of wire, No. 0000, and have about 250-horse power in motor capacity connected. There are thirty-six trimmer's carts, and nine night and day inspectors, troublemen's and meter inspectors' carts in service.



ENGINE ROOM OF THE ST. LOUIS ELECTRIC POWER AND LIGHT COMPANY.

The Carondelet Electric Light & Power Company. John Klauss, president; R. J. Kilpatrick, treasurer; F. W. Mott, secretary. Organized 1891. It operates the following: Two tubular boilers, 250-horse power each; two Corliss engines, 200-horse power each; two Thomson-Houston generators, 1300 16-candle power each. It has ten miles of circuit, and operates 2,600 lamps. Longest circuit, four miles. Rates, same as Missouri company.

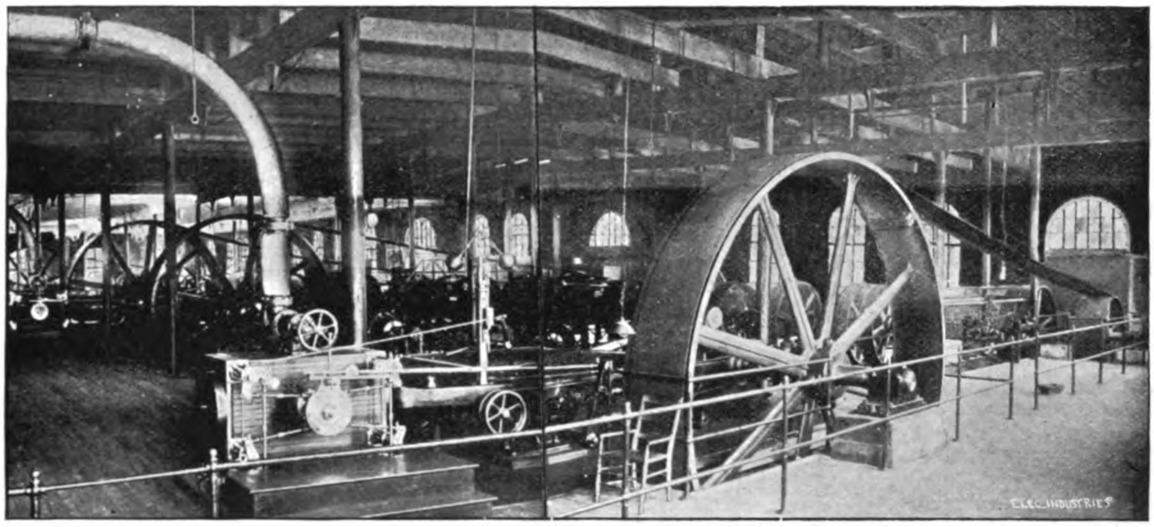
The St. Louis Electric Light & Power Company. Organized 1888. D. W. Guernsey, president; C. R. Scudder, secretary and treasurer. Office, 217 Lucas Ave.; plant, 210 Lucas Ave. It operates as follows: four 200-horse power tubular boilers at 100 pounds steam pressure; three 150-horse power Russell engines four valves; one 300-horse power Russell engine four valves; one 60-horse power Russell engine four valves; one 125-horse power Westinghouse Standard; two Edison generators No. 32 Standard; four Edison generators No. 12 Standard; one National generator of 250-horse power. They run at 220-volt pressure over fifty miles of circuits. There are dependent on this station 750-horse power in stationary motors ranging from ½ to 25-horse power. There also are: Two Excelsior arc light generators, 50 lights each; three Western Electric arc generators, 60 lights each.

The Laclede Power Company, of St. Louis. Organized November, 1890; H. C. Scott, president; E. V. Matlack, superintendent. Power is obtained from the steam plant of the Laclede Gas Light Company. It has the following apparatus: 700-horse power capacity in C & C generators, and operates 1,000-horse power in stationary motors on about eighty miles of circuits. The potential is 500 volts and the longest circuit five miles. This is believed to be the largest 500-volt stationary electric motor power plant in this country.

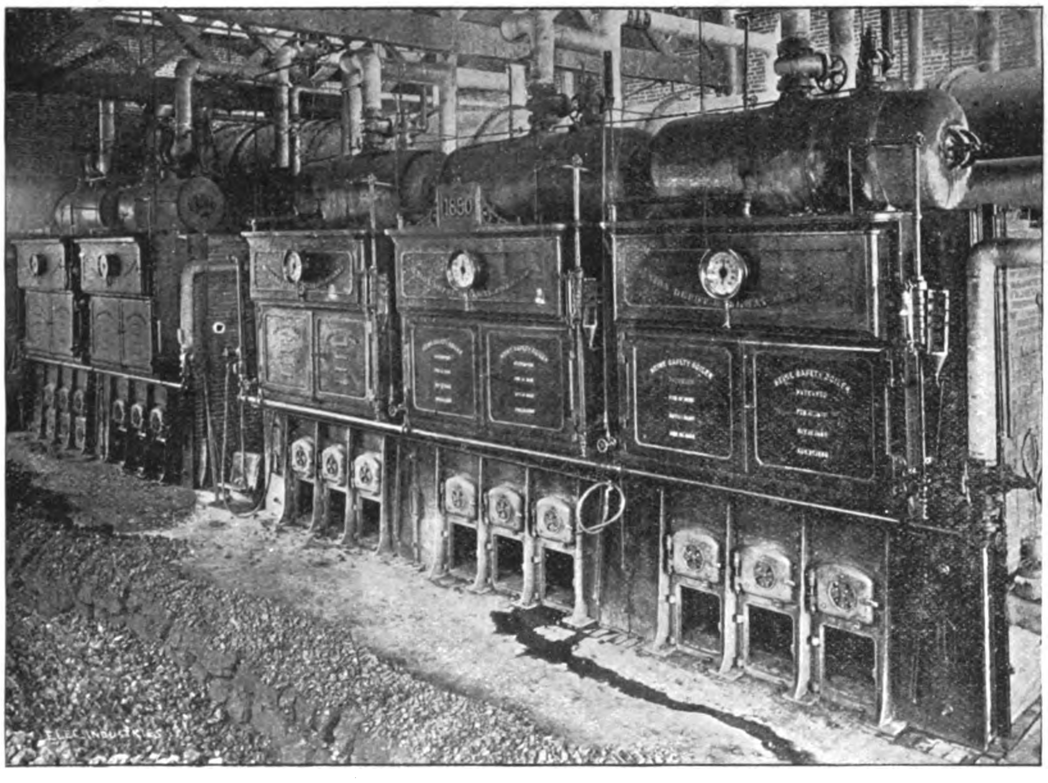
The Massachusetts railroad commissioners report the aggregate capital stock of the street railway companies in this state to be $23,540,536,—an increase of $3,986,583,-52 over the previous year. The gross indebtedness is $15,-052,903.38—an increase of $3,396,087.39. The aggregate stock and debt liability is therefore $38,593,439.38—an increase of $7,382,670.91. The total amount of property and assets of the companies, as reported by them, is $39,448,818.70—showing an apparent surplus over all liabilities of $855,379.32. The average cost of railway per track mile—including the cost but excluding the length of sidings—is $19,557.93 for permanent way; $15,199.35 for equipment, and $12,598 for land, buildings and other property—making a total average cost of $47,-356.05 for each mile of railway track.

The St. Louis & Suburban and Union Depot Railway Companies.

The plant of the St. Louis & Suburban Railway is one of the largest in St. Louis. It is situated at De Hodeamont station on the line of the road, about three miles from the down-town terminal, Sixth and Locust Streets, and about 100 feet beyond the western city limits. The building is a large brick structure, its dimensions being 190x100 feet. The equipment consists of three Hamilton-Corliss engines, 30x72, and one engine of the same make, 20x48. Each of the three large engines has a fly wheel weighing 50 tons, with a diameter of 24 feet and a 74-inch face. The fourth Hamilton-Corliss engine has a fifteen ton wheel. There is also an Ide 9x10 exciter engine. These engines run 12 generators of the Thomson-Houston make, two of which have a capacity of 250-horse power each, and ten a capacity of 150-horse power each. The boiler house contains ten boilers. Six of them have seventy-inch shells, with twenty-five six-inch flues, eighteen feet long; two have sixty-six-inch shells, with flues twenty feet long, and the remaining two boilers have sixty-six-inch shells, with flues twenty-two feet long.



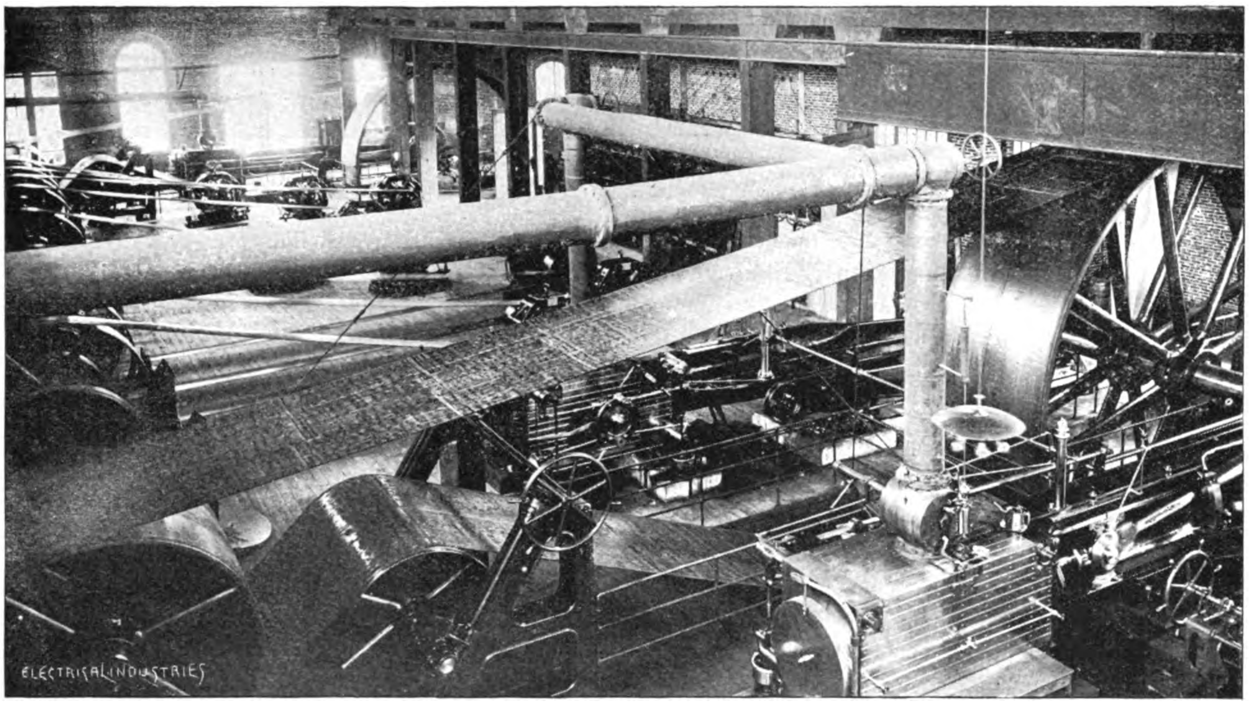
ENGINE AND DYNAMO ROOM UNION DEPOT RAILROAD COMPANY.



BOILER ROOM UNION DEPOT RAILROAD COMPANY.

A feature of the plant is the belting. It is the Shultz patent leather woven link pattern, manufactured by the Shultz Belting Company. Three of the belts are seventy-two inches in face, and 154 feet long; two are thirty-five-inch face, and ten are sixteen-inch face belts. Night and day, week in and week out, these leather bands are spinning around incessantly, taking from the engines the power which revolves the generators and creates the energy to carry thousands of people over the road.

The present St. Louis & Suburban electric railway is is the joint successor of the Cable & Western railway, and the old Narrow Gauge steam railway. The former was the first cable line in St. Louis, and used to run from Sixth and Locust Streets, along Locust Street, Thirteenth Street, Washington Street and Franklin Avenue to Vandeventer Avenue. The narrow gauge road used to run, years ago, from Olive and Cobanne Streets to Florissant, nineteen miles northwest of the city. Later its city terminal was at Vandeventer Avenue and Morgan Street. Over the combined routes of the Cable & Western and the Narrow Gauge roads the St. Louis & Suburban now runs its electric cars. There are twenty-eight miles of single track in the system, which includes the main line to Wells station, a double track branch to Forest Park and a single track extension to Florissant, which, as has already been stated, is nineteen miles from the city. The motive force which daily propels between fifty and sixty Thomson-Houston motor cars along this route, is the power house at De Hodeamont station.



POWER STATION ST. LOUIS & SUBURBAN RAILROAD CO.

The Union Depot Railroad Company which operates thirty-two miles of single track is another extensive railway system. In the power house which is located at the corner of Geyer and Missouri avenues are four Hamilton-Corliss engines. The boiler equipment consists of seven Heine safety water tube boilers, each with a capacity of 250-horse power. The electrical equipment comprises 22 Thomson-Houston bi-polar generators. Transmission in this station is by means of belting to a jack shaft, thence to counter shafting extending the entire length of the building, and on which are located friction clutches and pulleys.

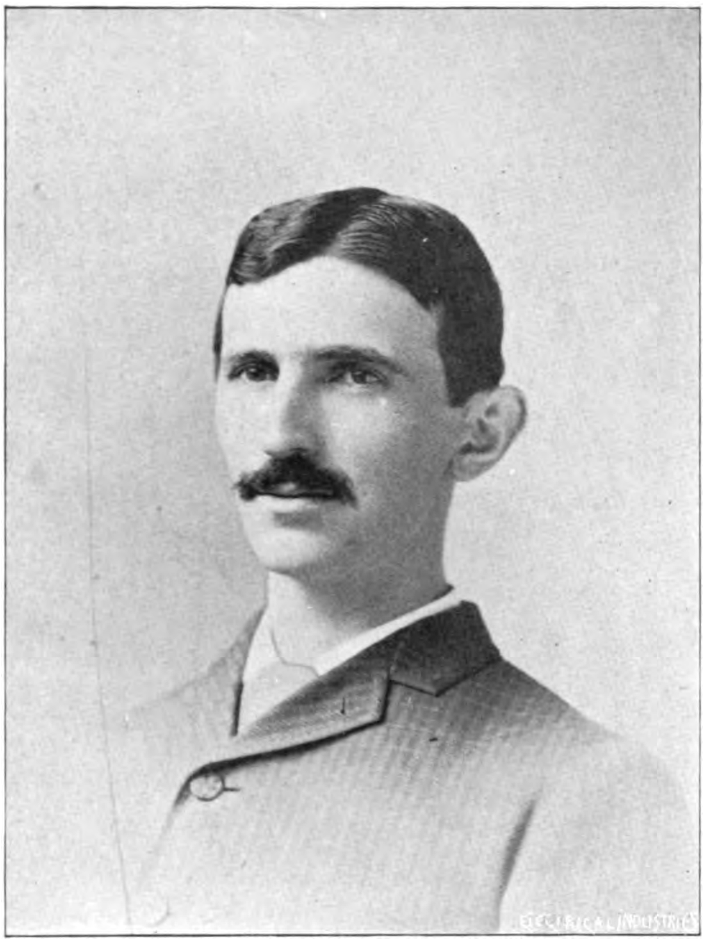
A lighting station has been built in St. Petersburg, Russia, for the lighting of numerous government buildings.

Mr. Nikola Tesla.

During the past year the electrical world has been much interested in the remarkable demonstrations of the possibilities of electricity that have been made by Mr. Nikola Tesla. Attention was first attracted to Mr. Tesla's work by a lecture which he delivered at Columbia College, New York City, in May, 1891. This lecture showed that the researches of Mr. Tesla were very exhaustive. In January last he sailed for Europe with invitations to lecture before the leading scientific organizations of the continent, and shortly after reaching England he gave a series of experiments in his lectures before the English Institute of Electrical Engineers, which received the highest commendation because of the depth of his researches. Probably no American electrician or scientific man was ever received by the scientific men of Europe with such honors as were conferred upon Mr. Tesla.

Mr. Tesla was born in Servia, but has been in the United States many years and has been connected with the Westinghouse Electric & Manufacturing Company, making extensive researches in connection with the alternating current. Mr. Tesla has demonstrated a number of facts of much importance as to the nature of electricity, and in his experiments has demonstrated in actual practice some of his deductions. Much interest has been attracted by his operating a motor on one wire and even without connecting it with a generator, and in the matter of electric lighting he has produced some startling results which open a field for wide research and give promise of remarkable developments in the near future in the improvement of electric lighting.

It grows more and more apparent that the steam engineer seeking for a position, if he has knowledge of common electrical apparatus, wins every time over the candidate who lacks this knowledge.


ELECTRICAL INDUSTRIES

Sincerely yours
Nikola Tesla

THE PERSONNEL

—OF THE—

BUSINESS SIDE OF ELECTRICAL ST. LOUIS.

THE SHULTZ BELTING COMPANY.

It is sixteen years since the Shultz Belting Company was organized. The company started in a very small way but has ever since steadily increased its facilities until it now operates one of the largest factories in the country in this line of business. At the same time that the company has increased its facilities its business has been extended in all directions until now it has branch offices in Boston, New York and Philadelphia besides agencies in all the large cities in the country; also in London, England; Moscow, Russia; Havana, Cuba; Brussels, Belgium; Sundsvall, Sweden; and in India, Australia and Japan. The factory of the company now covers an area 160x200 feet in size with three and four story buildings and 80 feet on the east side of Barton St., and 54 feet on Seventh St. Several large belts manufactured by this company can be seen in use in St. Louis In the power station of the St. Louis & Suburban Railroad Company are two belts 72 inches wide and 154 feet long and the Shultz company is now putting a third belt of this same size in this plant. One of these belts is shown in an illustration of this plant elsewhere in these pages. Users of belting will be interested to see in the factory now in process of making what is possibly the largest belt in the world. It will be 80 inches wide and is being made for the Toledo Electric Street Railway Company, Toledo, O. In addition to the regular lines of belting the Shultz company makes specialties. The Shultz patent sable rawhide belting is tanned only on the surfaces leaving the interior of the leather rawhide. This is the fiber of the material and it is softened and made pliable by a patent process. This belting is particularly adaptable for running at high speed over small pulleys and is very desirable for use in electric stations. Another specialty is the Shultz patent woven leather link belting. This is made of all rawhide leather, no iron or metal being used. Both sides of these belts are alike and if one side becomes worn the belt can be turned over and used on the other. A device for economizing in the use of power is the Shultz patent leather pulley covering. This covering is easily adjusted and will last a lifetime. A leather covered pulley is believed to drive 50 per cent more than an iron faced one. These and other specialties manufactured by this company are widely known in electrical stations because of their special adaptability for this service. J. A. J. Shultz is president of the company and B. C. Alvord secretary and treasurer.

Electrical Industries.

MR. J. A. J. SHULTZ OF THE SHULTZ BELTING CO.

THE POND ENGINEERING COMPANY.

In 1887 Mr. Frank H. Pond established the Pond Engineering Company's business with the intention of limiting it strictly to that of engineering. Mr. Pond's previous training had been in the engineering line, he having graduated from the Massachusetts Institute of Technology in the class of 1874. Soon after organizing this company it was evident that the greatest development was to be in the electrical line, and as there was great need of efficient and well designed power plants the new company was soon devoting a large part of its attention to this work. The step from engineering to that of contracting was a short one, and as the contracting business was extended it seemed best for the company to handle a variety of specialties connected with the installing of steam plants in order to be able to promptly fulfill all contracts that it might have in hand and at the same time use apparatus that it had perfect confidence in. Starting in with a few of the more important specialties connected with a steam plant, the company in a short time established a large machinery business. This was in a measure distinct from that of engineering, and in order to systematize the business which had increased to such a great volume Mr. Pond incorporated last year The Pond Machinery Company, thus separating the two departments of his business.

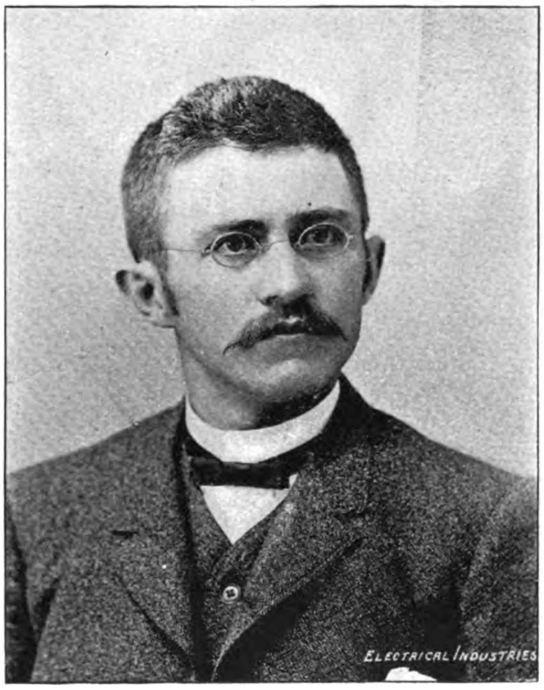
Electrical Industries

MR. FRANK H. POND OF THE POND ENGINEERING CO.

These two companies, however, although entirely distinct, are both under his personal supervision.

By thus systematizing the business the Engineering company can devote itself exclusively to strictly engineering work and contracting for steam plants for any purpose. Mr. Pond has constantly employed a complete force of erecting men of large experience, which guarantees the successful working of a plant. Starting in at a time when there were few electric light plants and almost no electric railways in St. Louis and the southwest, this company has steadily grown with the increased use of electricity. It has seen St. Louis become one of the greatest electrical centers in the world and has taken a very active part in bringing about this development. Throughout the west and southwest this company has been called upon to design the steam plants of many of the leading electric light and railway companies.

The Pond Machinery Company has now taken up a complete line of specialties in steam and hydraulic machinery, including engines, boilers, furnaces, feed water heaters and purifiers, boiler feed pumps, tank pumps and fire pumps, air pumps and condensers, injectors, separators, valves, pipe work, etc., etc.



MR. E. RUEBEL, OF THE ST. LOUIS ELECTRICAL SUPPLY CO.

THE ST. LOUIS ELECTRICAL SUPPLY COMPANY.

In 1890 the St. Louis Electrical Supply Company succeeded to the business and good will of the St. Louis Electric Company. Mr. W. S. Scott was president and treasurer of the new company and Mr. E. Ruebel vice-president and secretary. In October, 1891, however, Mr. Scott died, and Mr. Ruebel succeeded him as president and treasurer of the company shortly afterward, while Mr. W. N. Matthews was elected vice-president and Mr. Joseph Hummel secretary. This is the present management of the company. From the outset this company has done a general supply business and at the same time has entered largely into construction business, one of its latest contracts just completed being the installation of all the electrical equipment of the new Arlington hotel at Hot Springs, Ark. The business of the company has increased in such a manner under the present management that it now occupies a large store at 728 Locust St., while it has large warerooms at No. 809 of the same street. In perfecting its line of specialties the company has secured agencies of the following: The Crocker-Wheeler electrical apparatus, Laclede batteries, " K. K." wire, the Helios alternating arc lamps for the states of Missouri, Kansas, Texas, Arkansas and Colorado, and St. Clair and Madison counties in Illinois; also the Graves arc lamps, Packard incandescent lamps, Cutters C. S. specialties, Grimshaw wire, Carpenter heaters, etc.

THE COLUMBIA INCANDESCENT LAMP COMPANY.

There are few men in the electrical business who have such an extended acquaintance and who are more favorably known than Mr. J. H. Rhotehamel who is president of the Columbia Incandescent Lamp Company. Mr. Rhotehamel organized this company in July, 1889, and in January it was incorporated under the laws of the state of Missouri. Beginning in a quiet way the company rapidly built up an extensive business, and on Feb. 15th, 1890, moved to its present ample quarters at 1912–1914 Olive St. It occupies the entire building which consists of three floors and a basement, the area of each floor being 42 feet front by 109 feet deep. This factory is equipped with a complete steam and electric plant as well as a very complete outfit of all apparatus and scientific equipment necessary for the most economical and efficient manufacture of incandescent lamps. This is the oldest company in the west now in existence in the incandescent lamp business. It has a capacity of over 500 lamps a day. The trade of the company extends throughout the United States and from Canada on the north to Brazil on the south. Mr. W. Q. Garrison is vice-president and Dr. A. C. Garrison is secretary and treasurer of the company.

ELECTRICAL INDUSTRIES.

MR. J. H. RHOTEHAMEL OF THE COLUMBIA INCANDESCENT LAMP CO.

THE HEINE SAFETY BOILER COMPANY.

The history of the Heine boiler dates back some 15 years ago when the general idea of it was sprouted in Germany. In 1882 Col. E. D. Meier discovered the idea, brought it to this country, Americanized it, made a change here and there in the line of improvement, and then introduced it to his friends and the general public. In the early history of the water tube type of boiler the matter of selling one was slow work as the factors of safety and economy were not fully appreciated by boiler men, but the owners of the Heine boiler patents believed fully in the good qualities of their boiler, especially in the fact that the more free the flow of water and the greater the amount of water coming in contact with the active heating surface the greater the evaporation from a given amount of fuel burned. When the building of stations of larger capacity for both electric light and electric railway purposes became more general the good qualities of such a boiler as this became decidedly apparent. Now and then a boiler seemed to fall short of what was expected of it, but in each case it was found that the failure was due to faulty setting rather than to any inherent weakness in the boiler. Since then experience has taught the proper methods of setting. The Heine company made a special effort to install their boilers in large steam using plants and particularly in electric plants where the question of economy is always carefully considered and where high steam pressures are in great demand to secure the highest working economy in the engine. In manufacturing these boilers the Heine company adopted the exacting specifications of the American Boiler Manufacturers Association, as representing the ideal physical and chemical characteristics of boiler plate. A sheet of these specifications goes with each order to the steel mills and the plates are tested in accordance with them. The records of the test of each plate are carefully preserved so that the purchaser of any boiler can learn from the company exactly as to the test that the plate in his boiler or boilers underwent. Originally these boilers were made in St. Louis. At present the Philadelphia and Chicago shops turn out a large percentage of those that are made. The officers of this company are Col. E. D. Meier, president, and Theodore G. Meier, secretary and treasurer. Mr. Charles G. Foster, who has been the general manager of the company, has recently assumed important engineering duties in the mechanical department of the World's Columbian Exposition. The Heine boilers are found in large steam plants all over the country. One of the most interesting plants in St. Louis is that of the Union Depot Railroad Company. This plant ranks either second or third in size among the electric railway plants in the country, and the thoroughness of its construction and efficiency of its operation will be an interesting study to electric light men. The engineering work in this plant was done by Messrs. Meier and Foster. There are altogether in this plant seven Heine boilers of the K 16 size rated at 250 horse-power each. This plant has proved so successful that it has been frequently written up and described in trade journals. Another very interesting installation of Heine boilers in St. Louis is in the Anheuser-Busch Company's brewery.

ELECTRICAL INDUSTRIES.

COL. E. D. MEIER OF THE HEINE SAFETY BOILER CO.

ELECTRICAL INDUSTRIES

MR. LOUIS NAHM OF THE AMERICAN ELECTRICAL MFG. CO.

THE AMERICAN ELECTRICAL MANUFACTURING COMPANY.

The American Electrical Manufacturing Company, whose place of business is at 2011–2017 Pine St., is devoted particularly to the manufacture of incandescent lamps. Mr. Ben Nahm is the president of this company and Mr. Louis Nahm secretary and treasurer. Mr. Louis Nahm is widely known among electric light men and has been particularly active in organizing the St. Louis Electric Club and is chairman of the executive committee, a member of the finance committee, and of the banquet committee that has provided such ample entertainment for the members of the National Electric Light Association.

THE ROSE ELECTRIC LIGHT SUPPLY COMPANY.

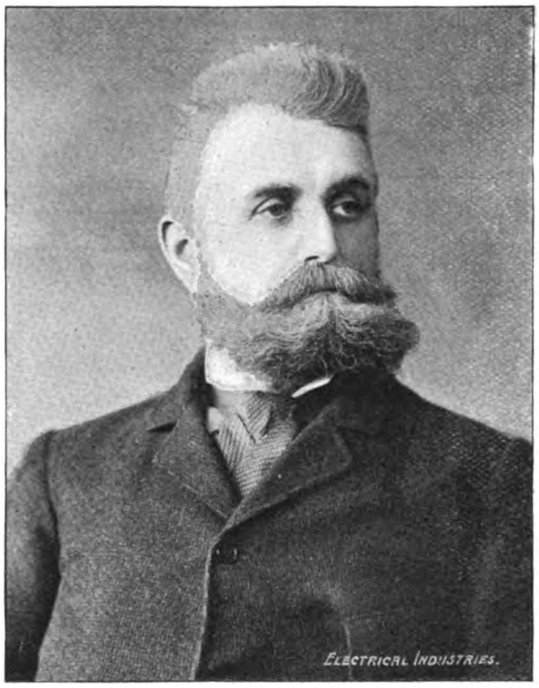
Among the many young men in the electrical business who have worked up quickly from small beginnings is Mr. P. L. Rose, secretary and manager of the Rose Electric Light Supply Company. Mr. Rose was born in Cincinnati in 1862. When 13 years old he became a messenger boy for the Atlantic & Pacific Telegraph Company. Mr. Wm. H. Eckert was at this time manager of the company, but later was with the City & Suburban Telegraph & Telephone Association of Cincinnati, young Rose going with him to take a position as an operator. After two years service here Mr. Rose left Cincinnati and went to St. Louis to become telephone inspector for the Bell Telephone Company for the state of Missouri. After serving for one year and as yet but 19 years of age, Mr. Rose saw an opening in the business of building private telephone lines, instruments being rented from the Bell company. Two years afterward Mr. Rose bought the interest of Mr. Karl Kammeyer who, with Mr. G. Reim, owned the Franklin Electric Works. The name was soon changed to the Rose & Reim Electric Works, the telephone and manufacturing businesses being consolidated. Electrical apparatus was not in much demand at this time, and the factory employed but eight hands. Later this company manufactured the famous Pan electric telephone instruments, magneto bells, and other devices, and also invented and put on the market the Rose & Reim telephone toll system. This opened up a wide field for business, and the company was employing 56 men and working day and night shifts, when the Bell company secured an injunction against them, and Mr. Rose sold out of the business. Two months later Mr. Rose started his present business, that of handling second hand electric lighting apparatus. At first he opened a small office, later a small warehouse, and business soon increased so that he soon moved to his present quarters, 1106 Pine St. Here the dynamos, arc lamps and other apparatus are overhauled, tested and put in condition practically as good as new for selling again. Frequently as many as 80 dynamos are in stock. The business has so increased that a large store house is now found necessary in the Mitchell building. Mr. Rose has traveled much himself, and is acquainted with many of the leading managers of electric light stations throughout the country. Last July it became necessary for the company to open an office in New York in the Electrical Exchange building, to handle its eastern business, and in a few weeks now a similar office will be opened in Chicago.

ELECTRICAL INDUSTRIES.

MR. P. L. ROSE, OF THE ROSE ELECTRIC LIGHT SUPPLY CO

THE EMERSON ELECTRIC MANUFACTURING COMPANY.

The Emerson Electric Manufacturing Company was incorporated in 1890 with J. W. Emerson as president, C. R. Meston, secretary, and A. W. Meston, superintendent, to manufacture all kinds of electric lighting and railway specialties. The company began business in a small way on Elm St. The specialties manufactured proved popular, and business became of such a volume that it became necessary for the company to seek larger quarters, and in 1891 it moved to its present location at 1108 and 1110 St. Charles St. At first the company seemed somewhat lost with its ample facilities and so much room, but now it is as closely pressed as formerly with its continual increase of trade. On the first floor are the offices of the company and the heavy presses for motor work. On the second floor is the machine shop, while on the third floor is the pattern shop and the assembling room. Each floor is 45x100 feet in size, thus giving some idea of the size of the establishment. Here can be seen all the operations of manufacturing electrical apparatus, and especially prominent just now is motor work as the company is laying in a large stock of alternating current fan motors for the coming summer season. After being connected with the company two years Mr. J. W. Emerson retired and was succeeded by Mr. H. L. Parker, who is now the president and manager of the company. The invention of the Meston alternating current fan motor a year ago, and its appearance on the market, has in some respects modified the original plans of this company, as the demand for these motors has kept the company very busy manufacturing them. During the fall festivities in St. Louis, a few months ago, the Emerson company put forth some very original ideas in the way of electrical street illuminations, and the success and novelty of these designs attracted wide attention and were fully illustrated in many journals. The company now has agencies in all of the largest cities in the country; also in England and other foreign countries, representing its line of specialties. The active


ELECTRICAL INDUSTRIES.

MR. W. L. B. G. ALLEN.

members of the company are young men who are energetic and pushing. They are all members of the St. Louis Electric Club and take active interest in its success.

MR. GEORGE J. PERCIVAL.

Among the electrical contractors that have been intimately connected with the upbuilding of electrical interests in St. Louis and the west is Mr. George J. Percival, whose office is at 219 Mermod-Jaccard building, corner Broadway and Locust St. Mr. Percival is a practical man who understands in all detail the requirements of a firstclass electric light plant. He has a wide acquaintance among electric light men and is favorably known for the engineering work that he has done. His special line of work is that of expert and superintendent's work and he at present has charge of the electric light departments of several of the largest and most important buildings in St. Louis. Mr. Percival has been an active worker in organizing the Electric club and has taken active part in furthering the preparations for the entertainment of the National Electric Light Association.

THE ENTERPRISE ELECTRIC COMPANY.

The Enterprise Electric Company is a branch of the well-known Chicago company of this same name. The St. Louis house was opened for business the latter part of August last, thus making it one of the newer electric establishments. The managers is Mr. W. H. Ferris, who has been connected with the electrical business in St. Louis for five years or so. This company handles a full line of electrical supplies. Mr. W. C. McKinlock is the president and treasurer of this company. Mr McKinlock has been connected with the electrical interests of St. Louis, Chicago, and the west for a number of years. Mr. W. F. Richardson is vice-president and general manager and Mr. George Dickinson, secretary.

THE INTERSTATE COMPLETE ELECTRIC CONSTRUCTION CO.

The Interstate Complete Electric Construction Company, 809 South Seventh street, does a large amount of construction work, from small installations up to the installing of a complete electric light or electric railway plant of any magnitude. In addition to this construction work this company manufactures a few specialties including lightning arresters and other apparatus. It also represents a line of specialties including the Heisler system of long distance incandescent lighting, and also apparatus for arc lighting, the transmission of power and other electrical purposes. William Wurdack is president of the company and Charles P. Lampel secretary and treasurer.

THE SOUTHERN ELECTRICAL SUPPLY COMPANY.

Among the supply houses that have been established for some time is the Southern Electrical Supply Company, 11 North Seventh street. This company is a branch of the Central Electric Company, of Chicago. It has a capital stock of $25,000, but does a volume of business many times the size of this in value. The manager of this company is Charles E. Sharp. Like the parent company this one carries a line of leading specialties including the Okonite products, Interior conduit, Washington carbons, and a full stock of general supplies.

MR. W. L. B. G. ALLEN.

Mr. W. L. B. G. Allen has been actively engaged in arranging for the entertainment of the National Electric Light Association, and is a member of the committee on invitations for the lecture by Mr. Nikola Tesla. Mr. Allen was one of the organizers of the St. Louis Electric Club and took important part in furthering the interests of this organization. He has been long connected with the electrical interests of St. Louis.

THE STANDARD ELECTRICAL CONSTRUCTION COMPANY.

The Standard Electrical Construction Company, whose office is at 613 Pine street, devotes its attention to consulting engineering and contracting. This company installs electric light plants, dynamos and motors, and does wiring for any system. The company is composed of I. Fajans, R. Rougtell and E. L. Hand.

FIDELITY CARBON MANUFACTURING COMPANY.

The works of the Fidelity Carbon Manufacturing Company will interest electric light men. This company manufactures special lines of high grade carbons; also arc light carbons, carbon brushes, plates and special battery carbons.

THE RANKIN & FRITSCH FOUNDRY & MACHINE CO.

The Ranken & Fritsch Foundry & Machine Company, 2201 Maine street, have manufactured many engines for use in electrical stations in the west and southwest, and station managers who are using these engines will be pleased to look over the factory in which they were built.

The Electric Light in London Fogs.

A London electrical paper states that arc lighting for streets has received a remarkable vindication during the recent heavy fogs in London, and it quotes from the daily papers a description of the excellent service rendered by the electric light through one of the heaviest fogs of an exceptionally foggy year. The electric light is practically only just coming into use in the London streets, yet an opportunity was afforded on the day in question to establish a fair comparison of the relative merits of gas and electric light in a dense atmosphere. An unanimous decision was recorded in favor of the electric light, and it is further stated that men who have spent the whole of their lives in the city of London were of opinion that the traffic in the streets which during a fog is always more o less impeded, and sometimes brought almost to a standstill, was facilitated by the increased power of illumination to an extent never before known.

The Telephone in Railroad Work.

Mr. C. A. Hammond, superintendent of the Boston, Revere Beach & Lynn railroad, in a recent paper published in the *Railroad Gazette*, calls attention to the growing tendency among railways to the use of the telephone in place of the telegraph in the transmission of train orders; and he urges its wider adoption for the purpose. Within the past year or two, the entire telephone service of his road has been changed to copper metallic circuit, using long distance transmitters with sufficient battery power to allow a dozen or more instruments to be placed on a single circuit; individual calls being distinguished by long and short rings as in the Morse code. Care has been taken to neutralize induction, and the line is found to be perfectly quiet day and night. He is of the opinion that there is no reason why the telephone, if proper precautions are taken, is not preferable to the telegraph for this class of work.

Electrical Industries.

Entered at Chicago Postoffice as second-class mail matter.

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E. L. POWERS, Pres. and Treas.
E. E. WOOD, Vice Pres.
H. L. ALDRICH. Secretary

EASTERN OFFICE, WORLD BUILDING, NEW YORK.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

Complaint comes from England that the rapacious financial promoter has retarded the development of the electric light in that country. The same has been true to a certain extent in this country, but he has not injured the prospects of private enterprise to the extent that he has in England. This rapacious individual however, is doing injury to electrical interests in this country just now, by consolidating companies, both light and railway, and floating bonds in such number as to permanently cripple the plants.

It is not a great surprise that the injunction should have been granted against the Beacon company in favor of the General company in the incandescent lamp litigation in Boston. This decision is probably not yet final which indicates that the litigation will be long drawn out. It certainly brings no relief to the incandescent lamp market and emphasizes still more strongly than ever, as was stated in these columns last month, that the General Electric Company owes it to electrical interests to bring an end to the present embarrassment.

The Board of Fire Underwriters at Boston, Mass., contemplate advancing rates upon buildings and their contents in the business sections of the city where electric wires run in front of or at the side of the building in such a way as to interfere with firemen in fighting fire. When a building is on a corner with wires running in two directions advance will not exceed 50 cents and in ordinary cases will not exceed 25 cents. In a large city like Boston there is no excuse for not having all wires under ground in the heart of the city, and such an increase in insurance rates as this ought not to be necessary for such a reason.

The fire in the plant of the Chicago Edison Company last month strongly emphasizes the importance of having strictly fireproof structures in electric stations. In this particular instance over 100,000 incandescent lamps and quite an amount of horse power in motor service was dependent upon this one station. Fortunately little damage was done, but had the station not been built as well as it was, and practically fire proof, business in the heart of Chicago would have been seriously crippled for a time. Had the damage been greater the effect would have been very serious to the continued progress of electric lighting. This matter of absolutely reliable light is of vital importance and is more and more appreciated each year.

THE CONVENTION.

Never before has there seemed to have been such widespread interest in a convention of the National Electric Light Association as in the present one. There are many reasons for this. First of all the convention has demonstrated fully and completely the necessity for its existence as it has proved quite invaluable to members and has drawn to it many new members. The present complicated situation as regards incandescent lamps is one of vital interest to nearly every station manager and there is every indication that this subject will be fully ventilated at this gathering. Both sides of the question will undoubtedly be fully considered and a full attendance and honest exchange of opinion on the subject must result in good.

Another reason why there will be a full attendance at this convention is because of the opportunity it will offer the members and friends of the Association to do honor to an esteemed member, Mr. Nikola Tesla, who has recently returned from an extended trip to Europe where his experiments and lectures have caused the widest interest and brought him great honors. In every respect the convention promises to be a marked success, both electrically and socially, and the city of St. Louis has made preparations to receive the convention which are in full keeping with the well known hospitality of this city.

CONSPIRACY OF THE WINTRY ELEMENTS.

The past three months have been a trying test of the efficiency and reliability of electrical stations. This is particularly true as regards electric railways which have had an unusually large amount of snow to contend against. In the west there have been several heavy falls of snow, one following another closely. Reports received from many roads by Electrical Industries indicate that there has been little difficulty in keeping cars in constant operation. Some of the better equipped roads have had their snow plows and track cleaners in constant operation during the storms, so that the delay to traffic has been comparatively trifling. Ice and sleet have also threatened serious interruptions. Sudden and extreme jumps in temperature have caused an unusual amount of moisture and ice, and overhead electric constructions have had their stability well tested. But recent improvements in the manner of making these overhead constructions have been equal even to these extreme and adverse conditions. The elements could not well form a more thorough conspiracy against electric constructions than they have done this winter, and the efficient working of these constructions under such severe and constant tests are very gratifying to all friends of electrical advancement.

SOME RESULTS OF OUR INEFFICIENT PATENT OFFICE.

Legal complications seem to be threateningly conspicuous in the electrical field just now. The incandescent lamp suits are far from settled as yet, and are seriously interfering with business, as was stated in these columns last month, and with the promise of several new types of lamps the prospects are for more rather than for a cessation of litigation. In the electric railway field, the General Electric Company, which already held valuable patents, has fortified its position by purchasing the Green patents, and rumblings of war are heard, threatening to entangle many interests with the owners of the Field patents hot in the contest defending their rights. Still another bitter contest is threatened over the three wire system. The patents on this system have been sustained in England. The Westinghouse company owns these patents and the suit which has been pending in this country some time against the Edison three wire system, will have life infused into it because of this English decision. Telephone interests, too, are not without danger of contamination of litigation with the complications over the Berliner patents which the government has asked to have expunged from the records.

Were the patent office as efficient as its friends claim for it, there would not be such a series of suits as these to hamper and injure electrical interests. Before matters are worse than they now are there should be an overhauling of the patent office with a view to removing rottenness and dead wood.

MUNICIPAL OWNERSHIP OF ELECTRIC LIGHT PLANTS.

During the past few weeks there has been an usual amount of agitation of the subject of the municipal ownership of electric light plants. The leading article in the *Review of Reviews* discusses the subject at considerable length and publishes comparative tables of statistics from stations in actual operation, from which it deducts the conclusion that such municipal ownership causes a saving of nearly $20 a lamp per year. Another article on the same subject, which has attracted attention, was a message from Mayor Matthews of Boston, asking that the city be authorized to establish its own electric light plants. In this message he presented figures to show that under such ownership the city would save between $30 and $40 per lamp per year.

The question of municipal ownership is a political as well as an economic one. The consensus of opinion in this country has always been against a paternal government—against the local, state or national government going into business to compete with individual citizens, though there are exceptional cases which have been admitted as successful, such as the post office by the national government and a water supply by most municipalities. But the transmission of electricity for purposes of light and power is a special line of business. All indications point to a condition of affairs in the near future when practically all the lighting of residences, commercial and other buildings and streets will be done by electricity, while all small power plants will depend upon electric motors. If the supplying of electricity for all these uses is in the hands of private individuals, we believe its use will be more general than would be the case were there municipal ownership.

The affairs of a municipality should be run on a business basis, the same as any great business should, and if a saving can be made each year by a city running its own light plant, business policy would indicate that this saving should be made; but because there has been this apparent economy in a few instances, it does not by any means follow that such will be true in all cases. We have in mind several municipal lighting plants that have started out with the purpose of reducing the expense of street lighting, but which have found in the long run that there was no saving, while, on the other hand, with many of them, there has been an even greater cost of lighting than when private corporations furnished the light. We doubt very much if municipal lighting, on the whole, has shown anything like the saving that is claimed. And for a municipal plant to go into commercial lighting or selling current for power purposes, is not just to private enterprise.

Program—National Electric Light Convention.

The full program for this, the sixteenth convention of the National Electric Light Association as officially announced, is as follows:

TUESDAY, FEBRUARY 28.

Meeting of the Executive Committee at 9 A. M.,
Parlor, Southern Hotel.

MORNING SESSION, 10:30 O'CLOCK,
Bell Telephone Building.

Address of Welcome, Hon. E. A. Noonan, Mayor of St. Louis.
Address, President James I. Ayer.
Report. Committee on Data.

AFTERNOON SESSION, 2 O'CLOCK.

Report. Committee on Safe Wiring.
Report. Committee on World's Columbian Fair.
Paper. A. D. Adams, Wrought versus Cast Iron for Field Magnet Frames.

WEDNESDAY, MARCH 1.

MORNING SESSION, 10 A. M.

Paper. H. C. Myers, Preservation of Poles and Cross Arms.
Paper. Charles S. Bradley, Long Distance Transmission of Power.
Paper. L. B. Stillwell, Under What Conditions is the Use of Water Power Economical?

AFTERNOON SESSION, 2:30 O'CLOCK.

Paper. E. A. Armstrong, Morals of Corporations.
Paper. R. H. Sterling, Some Experiences With the Alternating System.
Paper. William Brophy, Relation of Insurance to Electric Lighting and Power.

EVENING SESSION, 8 O'CLOCK.

Lecture by Nikola Tesla.

THURSDAY, MARCH 2.

MORNING SESSION, 10 O'CLOCK.

Paper. W. H. Browne, Underground Conduits and Conductors.
Paper. Calvert Townley, Incandescent Lamp from a Commercial Standpoint.
Paper. Louis Bell, Subject to be announced.

AFTERNOON SESSION, 2:30 O'CLOCK.

Paper. ———

EXECUTIVE SESSION.

Report. Secretary and Treasurer.
Election of Officers.

The space left vacant in Thursday's afternoon session is for a possible paper by Professor George Forbes, of London.

The St. Louis Electric Club has perfected elaborate arrangements which give every promise of royal entertainment. The club has decided that there shall be no formal banquet on Thursday evening, but some other interesting attractions have been provided instead. So far as the entertainment committee could make arrangements the following program has been agreed upon:

Tuesday evening—A visit to the Missouri and Municipal electric light plants and, if time permits that night, a visit to the power plant of the Union Depot Railroad Company.

Wednesday night—The Tesla reception.

Thursday evening—A visit to the power plants of the Lindell and Bellefontaine railway systems.

Friday—An excursion on the suburban to the power station at De Hodeamont and then a trip to the end of the line, giving the excursionists a ride over the longest electric railway in the world. Returning by the suburban spur to Forest Park, carriages will convey the party through the park and through Tower Grove Park, and thence to the Jockey Club, where luncheon will be served.

It is proposed that each attendant at the convention wear a badge, and each badge will designate the wearer's relationship to the convention, as follows:

President, gold button, red bow;
Officers, Association button (sterling silver), red bow;
Executive Committee, same button, blue bow;
Honorary Members, same button, white ribbon;
Active members, same button, purple ribbon;
Associate Members, same button, violet ribbon;
Reception Committee, same button, yellow ribbon;
Guests, olive ribbon.

Electric Lights for Railway Signals.

BY SAMUEL SHERMAN.

The railroad crossing at Twenty-second street and Stewart avenue on the south side of the city of Chicago is the most important railroad junction of the roads leading out of the city. Owing to the increasing number of trains passing here, and the correspondingly increased danger of accidents, it became necessary to put in an interlocking plant controlling all crossings, switches and signals from a central tower. The contract for the installation of such a plant was awarded to the Union Switch & Signal Company, Pittsburg, Pa., for an electro-pneumatic interlocking plant.

In this plant, which will be completed in time for operation during the World's Fair, the power used to throw all switches and signals is compressed air, operated and controlled electrically. The compressed air and electric current for its operation are both obtained from a power house located near the crossing.

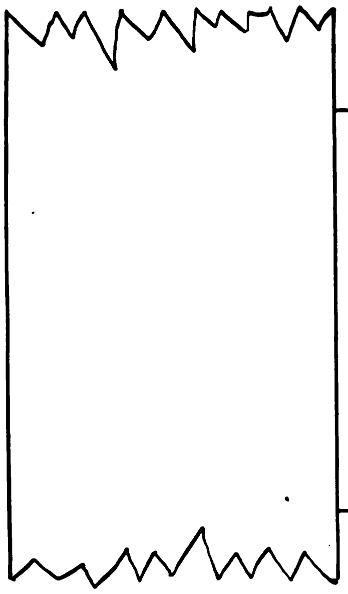


FIG. 2—ELECTRIC LIGHTS FOR RAILWAY SIGNALS.

With the question of installing this plant came also the question as to the practicability of lighting the numerous signals necessary by electricity. An experiment of this nature had been tried but once, and that was in San Francisco, when under very dissimilar circumstances it achieved but a doubtful success.

The arguments for the use of electricity for lighting signals are plain, better and more constant light; saving of oil; cleaning and care of lamps; readiness at all times; and quickness and facility of lighting and extinguishing the entire yard. The arguments against its use must necessarily be greatly influenced by the conditions to be encountered. The cost of wire, for instance, would vary greatly, depending on the number and distance of the lights. In a yard where the signals are numerous and closely grouped, there are always some outlying signals which will either greatly increase the cost of wire or suffer from loss of candle-power due to drop of voltage along the wires.

Another considerable item in the cost of the wire is the fact that it must be weather-proof and suitable for use underground—lead covered, in other words. Then there is the cost of laying it in ditches or conduits. Altogether, the greatest argument against the use of such a plant as we have been considering is the cost of installation. The minor objections are: cost of coal, which is cheap and easily obtainable to a railroad company; cost of services of engineer and fireman; and cost of lamps and repairs.

The conditions in the plant in question are exceptionally favorable. A power house, with boilers, air compressors and a small dynamo for charging the storage batteries, were necessary to the interlocking system. So the only additions to be made were engines and dynamos, with increased boiler capacity. The working force in operation needed no increase. The yard was already laid out with lines of wooden boxing running from the signal tower in the center to each division of the yard. This boxing was built for and held the interlocking wires, but was available also for the electric light cables. One branch of this boxing ran near the power-house.

Eighty-five lights were needed for the signals, a dozen more for use in the signal tower, and about twenty more to light the power house. Besides running these the dynamo must charge the thirty cells of storage battery used for the interlocking work, if necessary, although a small fifty-volt dynamo was provided for that purpose.

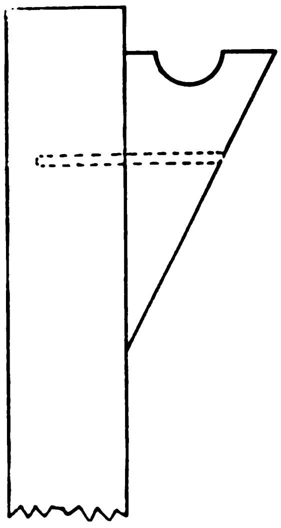


FIG. 1—ELECTRIC LIGHTS FOR RAILWAY SIGNALS.

It was at once apparent that to insure absolute certainty of operation, all machinery must be in duplicate. So the following plant for the work required was installed: Two 75-horse power tubular return draft boilers, made by Munroe & Son; two 55-horse power compound compressors; two 25-horse power Westinghouse compound engines, and two Westinghouse motor type compound wound 125-volt dynamos, with a capacity of 150 lights each. The engines and dynamos were geared to the same shafting, so that either engine may run one or both of the dynamos.

The wiring of the power-house and switch-board presented no peculiar difficulties and was done in the usual way. In the problem of wiring the yard the signal tower was selected as the center of distribution owing to its central location and the fact that it was the terminus of each line of boxing from the different portions of the yard. Lead-covered 00 cable was run from the power-house to the tower, and lead-covered feeders, ranging in size from No. 2 to No. 6, were run from there to the different parts of the yard, all kept in the wooden boxing. It was manifestly undesirable to allow the electric cables to lie on the switch wires which partly filled the boxing, both on account of the danger of a ground and the possibility of induction. Ordinary cleats would not support the cables, as owing to the limited size of the boxing, the cables would have to be taken out wherever it was necessary to make a splice. So a kind of cleat was made which supported the wire and also allowed its ready removal at any time without damage to the cleat. It was made in the form shown in Fig. 1, the wire lying in the circular groove in the top.

The next question of how to make the heavy joints so that no slack would be left in the boxing was answered by the use of brass connectors. The problem of thoroughly protecting and waterproofing all joints was done by a liberal use of rubber tape and Challerton's compound. Then came the work of laying the wire in ditches under the tracks from the main boxing to the separate signals. The signals were grouped in bunches of twos and threes and one line of wire run to each group. The wires were sunk deeper than the bottom of the ties, so that repairs or changes to the tracks would not molest them, and they were protected from mechanical injury, such as the chance blow of a pick or a shovel, by enclosing the wires in wooden trunking, made of inch stuff, with a heavy board covering. Thus the wires were successfully run from the feeders to the signal posts.

Wherever the wires were tapped the main feeders to a cutout were placed. But how to make the cutout waterproof was a question, Finally cast iron fishing boxes were obtained and the cutouts placed inside of them. The holes were fitted with vulcanite tubing and well compounded, and the cover screwed on to a rubber gasket.

The signals used in the yard are of two kinds, semaphores and dwarf signals. The semaphores on wooden posts twenty feet high were comparatively easy to wire A wooden cutout box, made of two-inch stuff and fitted with a door and padlock, was placed at the base of each tall signal where the wire came up out of the ground in the wooden trunking. From the top of the box the lead covered wire ran up the side of the post, protected for ten feet by an iron pipe, but above that held on to the post by cleats. At the top weatherproof flexible cord was spliced to the lead covered wire and this cord ran into a porcelain receptacle fastened to the under side of a wooden bracket. Tin covers were afterwards placed over the brackets. The bracket and receptacle are roughly shown in Fig. 2. The dwarf signals, three feet high and made entirely of iron, were a more serious problem to wire. The oak base on which they stand was made use of to hold the cutout as the only available place. A recess six inches long, four inches wide and an inch-and-a-half deep was chiseled in this base. In it the cutout was placed and the whole protected by a cast iron top fitting closely on a rubber gasket. From the cutout the lead covered wires were run up the side of the signal to a receptacle fastened to the underside of a hardwood bracket screwed to the signal post.

The only remaining difficulty was to provide some plug and socket arrangement to connect the lamp itself in its position between the red and blue spectacles with the receptacle socket. It was immediately seen to be advisable to leave the regular lantern on the signal and put the lamp inside, both to protect the lamp and direct its rays, and to provide a ready source of light in case of the failure of the electric lamp. The conditions were well fulfilled by a hardwood plug with a tin top made to fit water-tight into the top of the lantern. The socket to hold the lamp was screwed to the under side of the wooden plug and connected by a flexible cord enclosed in rubber tubing to an ordinary electric light plug fitting into the receptacle socket on the signal. The wooden plug with its socket attached is of such a shape that the lamp can be burned inside the lantern without interfering in the least with the ordinary oil burner, which can be lighted as soon as the wooden plug is withdrawn from the top of the lantern.

It is expected of this plant that the saving in its use over the old method of lighting by oil lamps will be great enough to pay for its cost in a few years. Exact figures cannot be given as yet, but a rough estimate of the original cost, the interest on the same and the deterioration in two or three years, gave a figure not far from the wages during that length of time of the two men required to take care of the lamps under the old system. The saving in oil would about be offset by the increased coal burned by the plant when the dynamos were running.

Electricity at the World's Fair.

The Electricity building that has stood all winter practically tenantless, except the offices of the department at the south end, has begun to assume a liveliness and bustle that promises well for an auspicious opening on May 1st. The latest preparation being made for the receipt of exhibits is the construction of two iron turn-tables, one at each of the railway entrances at the south end. These turn-tables will be completed this week and will be of sufficient size and strength to allow the big railway cranes to enter the building from the main tracks. The construction of these turn-tables will complete arrangements for handling the bulk of the exhibits. Up to this time, teams and trucks have been able to handle the business connected with the installation of exhibits.

Up to date the following firms have entered upon work at their respective spaces:

General Electric Company, Western Electric Company, Brush Electric Company, Fort Wayne Electric Company, Perry & Rundlett, The India Rubber Comb Company, Field Engineering Company, Western Electric Instrument Company, The Norwich Insulated Wire Company, The Standard Electric Signal Company, Waddell-Entz Company, Washburn & Moen Company, The Billings & Spencer Company, Hope Electric Appliance Company, The Roessler & Hasslacher Chemical Company, New England Butt Company, Utica Electric Manufacturing & Supply Company, F. A. Ringler Company, Ford-Washburn Storelectro Company, Day's Kerite Company, North American Electric Company, The K. A P. Electric Company, The National Carbon Company, Union Electric Company, Eddy Electric Manufacturing Company, Standard Underground Cable Company, Chicago Electric-Wire Company of Delaware, Electric Appliance Company, Page Belting Company, T.H. Brady, Waterhouse Bros., The E. S. Greeley & Co., The Electric Supply Company, Turner D. Bottome, The Illinois Alloy Company, Gamewell Fire-Alarm Company, James W. Queen & Co., Munson Lightning-Conductor Company, Electric Heat Alarm Company, New York Insulated-Wire Company, H. W. Johns Manufacturing Company, C. J. Hirlimann.

By next week nearly every exhibitor will be in the building.

It is gratifying to know that the electrical exhibitors are ahead of all others in their preparations; it is also matter for congratulation that the department under Professor Barrett has been the first to send the manuscript of its official catalogue to the printer This does not mean that those whose exhibits were not included in this first installment will be omitted from the first edition. Professor Barrett is to receive the proofs of his catalogue, and in this he purposes to incorporate the late arrivals and exhibits of those who have added to their original classification. It is proposed to have a complete catalogue for our electrical department for the opening day of the fair, though it is now acknowledged that most of the other departments will not be completed until June or later, so far as the catalogue is concerned.

ELECTRICAL-INDUSTRIES

PROF. BARRETT, CHIEF OF WORLD'S FAIR DEPARTMENT OF ELECTRICITY IN HIS OFFICE.

Apropos of the catalogue, Professor Barrett has secured from the Director-General an amendment to the classification of the department, which will give the addition of a new group of articles not fully or completely covered in the present classification.

As the groups and classes run consecutively through all the departments it was found necessary to distinguish the new group by an alphabetical suffix, and to observe the same form of distinction in the matter of the classes, so that the general numbering through the departments might not be disturbed. The new group is intended to cover many articles which are merely auxiliary to the exhibit proper, but which of necessity must be shown in the Electrical building along with electrical apparatus.

A temporary elevator of ample capacity has been erected at each end of the building to aid in installing exhibits in the gallery. These elevators are operated by electricity and are to be removed as soon as the work of installation is done.

Mr. Frederick Sargent, who for some months has been Engineer-in-Chief of the combined electrical and mechanical department, has been made general manager of this department. By this promotion Assistant Electrical Engineer Pierce drops the word assistant and Mr. Charles F. Foster, recently general manager of the Heine Safety Boiler Company, becomes mechanical engineer. By these changes and promotions Mr. Sargent is relieved of all detail work, thus giving him more time to look after the best interests of this department.

In operating street railway plants by electricity generated by water-power, says *Engineering*, the excessive variations of load unavoidable in such service has rendered the problem of efficiently regulating the generating power an extremely perplexing one. The inertia and incompressibilty of water render it impossible to control the flow with sufficient promptness to follow closely the sudden changes of load. In a street railway plant at Oswego, N. Y., this difficulty seems to have been met quite successfully by the use of an artificial resistance of iron wire of a capacity nearly equal to the maximum output of the generators. This makes a compensation which may be automatically varied so as to maintain a constant load on the generators, notwithstanding the fluctuations of the live load.

The large tunnel which is to be the tail race for the turbines in the Niagara Falls power plant is completed and the entire equipment is promised to be ready to run this month.

Gas Engines for Electric Lighting.

At a recent meeting of the London Institution of Civil Engineers, Mr. J. Emerson Dawson read a paper on the above subject, in which he stated that in Great Britain alone gas engines had been sold for electric lighting purposes exceeding in the aggregate 7,000-horse power, and that in Germany they are now used for about 1,100 arc and 90,000 glow lamps.

It is believed that the late Sir William Siemens first drew attention to the fact that, when illuminating gas is burned in a gas engine to drive a dynamo, much more light is produced electrically than can be produced by consuming the same quantity of gas in burners in the usual way. Latterly the consumption of gas per horse power in gas engines has been reduced; and the ratio is at the present time about 20 to 1 in favor of converting the gas into an arc light by means of a gas engine. The author has collected data from various sources, as to the consumption of ordinary gas by engines supplying electric light, with and without accumulators. The average of all the returns, with engines under varying loads and without accumulators, is about 47 cubic feet per kilowatt-hour. When accumulators are used, the consumption of gas is less, because the engines then work under full load. With 47 cubic feet per kilowatt, and 55 watts per 16-candle power, one light of this power requires only 2.6 cubic feet per hour; whereas a standard Argand burner requires 5 cubic feet per hour. In making this comparison, it was assumed that the glow lamps and gas burners were in good order; but, under ordinary working conditions they did not maintain so high a duty.

Mr. Dowson pointed out that the question of load factor is a serious one with any type of engine; but the gas engines the loss is much less than with steam engines. When a gas engine is stopped, its consumption of fuel stops also, and there is no furnace to maintain; nor is there any water to boil at starting. At the same time, it is desirable that gas engines should be worked as much as possible under a full load.

Some Electric Light Statistics.

It is some time since Electrical Industries has published statistics of the electric lighting central stations of North America, but this is not by any means because there has not been steady and continued growth. It will be seen from the figures given below that there are now 1,950 central lighting stations in the United States while in Canada, Cuba and Mexico there are 158. The stations in the United States alone represent practically $200,000,000 in capital stock.

Pennsylvania heads the list with the largest number of stations, having 180, while New York has 166, Illinois, 155, Ohio, 127. These show satifactory increases over statistics which were published eighteen months ago.

These statistics show conclusively what an important factor in the financial as well as the commercial world electric lighting from central stations alone has become. Six hundred thousand-horse power represents a most astonishing growth for an industry that is scarcely yet ten years old.

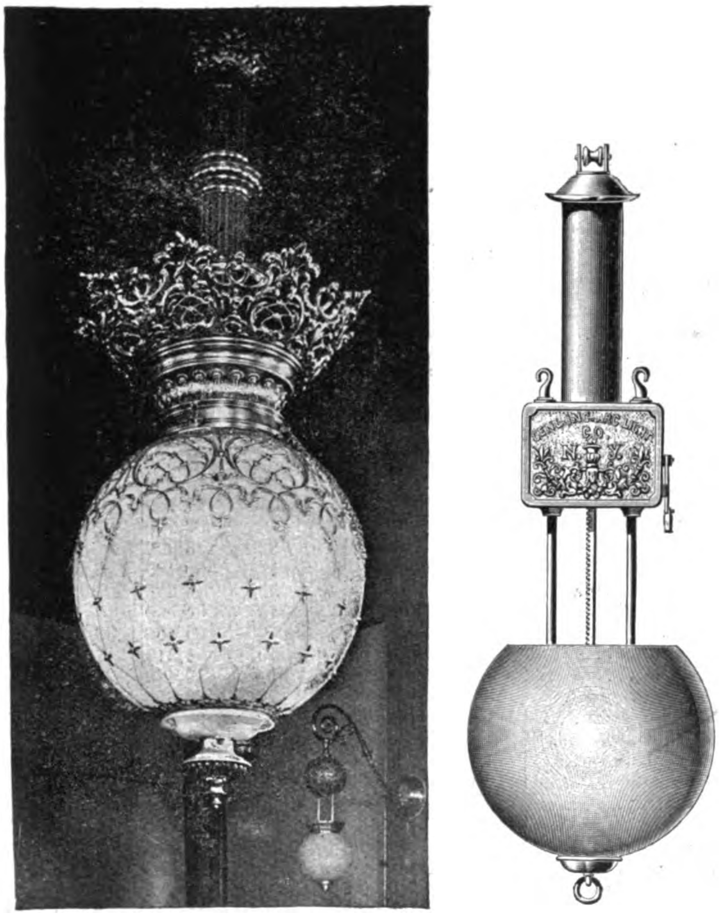
During the past year and a half there have been a large number of consolidations of stations, consequently the number of stations in each state does not represent the growth of the electric lighting business nearly as correctly as do the number of lamps both arc and incandescent. In considering these statistics it should be borne in mind that no private or isolated plants are included. As these private and isolated plants probably represent half as much again investment as the central stations a close estimate can be given of the total capital invested in electric lighting.

STATE.	NO. CENTRAL STATIONS.	CAPITAL STOCK.	NO. ARC LIGHTS.	NO. INCANDESCENT LIGHTS, 16. C. P.	ENGINE, H. P.
Alabama	26	$ 2,058,000	2,545	16,865	5,840
Arizona	2	120,000	85	1,200	230
Arkansas	16	1,055,000	800	12,275	2,500
California	54	15,128,000	7,185	42,030	15,770
Colorado	37	3,617,000	8,062	104,785	18,560
Connecticut	34	2,487,000	4,480	55,300	18,500
Delaware	4	335,000	200	18,900	1,260
Dist. of Columbia	2	1,525,000	600	12,000	1,800
Florida	11	539,000	447	17,000	1,700
Georgia	25	2,301,000	2,890	24,690	7,810
Idaho	6	215,000	225	6.260	875
Illinois	155	10,488,000	18,684	277,910	85,285
Indiana	97	5,258,000	8,448	70,530	19,100
Iowa	82	5,367,000	3,960	96,035	16,875
Kansas	60	3,942,000	2,979	38,180	8,485
Kentucky	27	1,797,000	1,890	29;120	6,840
Louisiana	8	1,185,000	1,890	29,250	4,805
Maine	37	2,658,000	2.409	38,885	8,355
Maryland	17	2,480,000	2,620	30,115	5,500
Massachusetts	91	11,557,000	15,480	258,720	45,440
Michigan	98	6,012,000	10,890	134 630	26,000
Minnesota	41	3,526,000	4,250	72 415	13,100
Mississippi	9	452,000	645	3,670	1,320
Missouri	69	16,546,000	7,600	119,125	21,855
Montana	14	1,315,000	875	18,100	3,515
Nebraska	33	2,545,000	1,900	34,550	7,270
Nevada	8	130,000	202	880	440
New Hampshire	25	1,426,000	2,214	17,700	6,300
New Jersey	48	5.162,000	6,550	89,200	17,855
New Mexico	4	275,000	82	3,000	850
New York	166	37,623,000	39,010	500,430	118.800
North Carolina	18	1,084,000	925	6,275	2,010
North Dakota	5	555,000	115	4,500	820
Ohio	127	8,513,000	15,650	139,560	33,635
Oklahoma	2	130,000	55	1,210	225
Oregon	23	2,125,000	1,506	19,420	4,550
Pennsylvania	180	15,088,000	19.120	396,500	62,600
Rhode Island	12	1,232,000	2,383	29,765	6,465
South Carolina	11	356,000	540	6,370	2,000
South Dakota	13	493,000	450	9,000	2,050
Tennessee	20	883,000	1,876	17,185	4,830
Texas	59	5,066,000	2,950	63,500	11,000
Utah	7	513,000	430	7,580	1,100
Vermont	15	704,000	1,322	13,310	3,620
Virginia	29	1,142,000	1,705	24,000	5,450
Washington	34	7,842,000	3,300	42.065	9,055
West Virginia	17	800,000	870	16,745	3,000
Wisconsin	70	4,067,000	5,000	81,400	14,900
Wyoming	7	279,000	135	11,000	1,170
Totals, U. S.	1,950	$199,886,000	207,824	3,057,585	600,815
CANADA, CUBA AND MEXICO.					
Alberta	1	$25,000	....	850	70
Assiniboia	1	30,000	....	750	75
British Columbia	5	718,000	480	5,300	1,280
Manitoba	3	340,000	126	8,675	1,200
New Brunswick	9	1,264,000	875	12,845	2,435
Newfoundland	1	46,000	100	400	140
Nova Scotia	11	851,000	700	12,050	2,000
Ontario	98	4,344,000	14,575	55,500	14,130
Prince Ed'rd Is'ld	1	50,000	105	500	60
Quebec	11	1,078,000	2,282	9.470	6.500
Cuba	3	275,000	400	6,700	1,020
Mexico	14	353 000	1,035	6,160	1,680
Totals	158	$9,374,000	20,678	119,200	30,590
	2.108	$209,260.000	228.502	3.176,785	631,405

A very pretentious company has been organized in New England whose purpose as set forth is to consolidate all the street railways of New England.

Arc Lamps for Incandescent Circuits.

There has recently developed a great demand for arc lamps to run on incandescent circuits. To satisfy this demand the General Incandescent Arc Light Company, New York, has introduced a new type of lamp which is particularly designed to this service. The mechanism of the lamp is very simple, there being but one magnet, three wheels and a spring. The upper carbon holder has a simple universal joint which permits the carbons to be made perfectly true. These lamps are made in various designs as will be seen from the accompanying illustrations and are made in different candle powers. By making the lower carbon-holder removable from the bottom of the lamp it is not necessary to remove the globe in trimming. This lower holder consists of a slotted screw which automatically grips the carbon. Both carbon holders are designed to hold any size of carbon. These lamps are designed to run two in series, and they can be used up to 6 amperes three in series on a 110-volt circuit, or six in series on a 220-volt circuit. Each lamp is provided with a resistance which is placed at the top and surrounding the upper carbon tube. By the use of this device the candle-power of the lamp may be readily regulated. These lamps burn very steadily and they show much economy in the use of current.

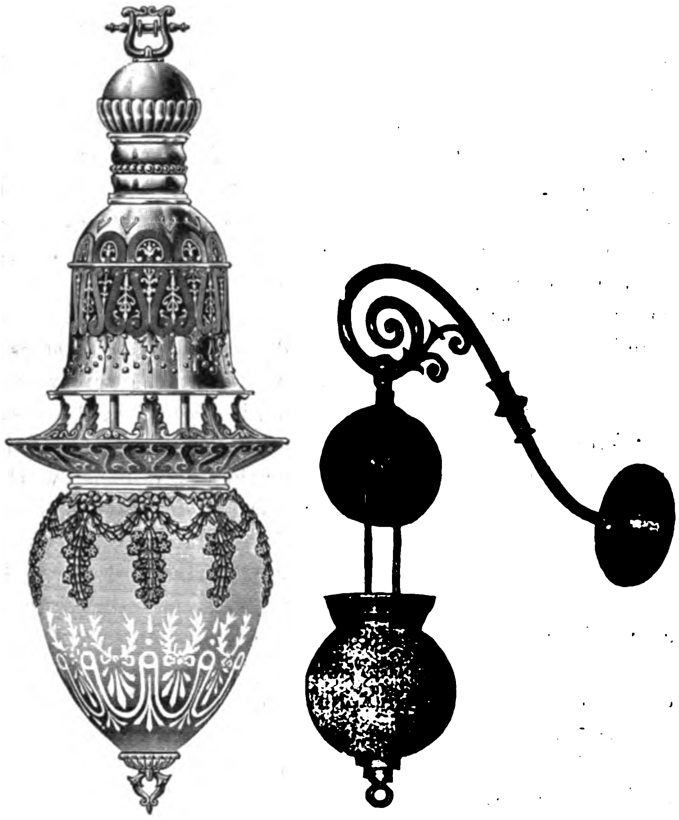


ARC LAMPS FOR INCANDESCENT CIRCUITS.

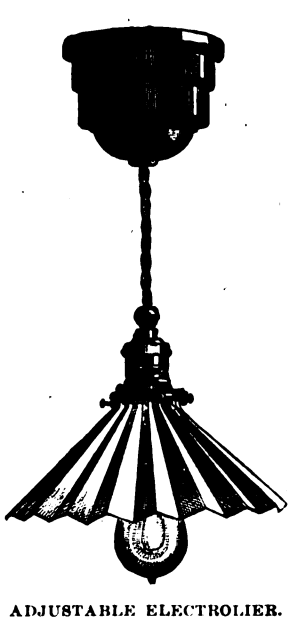
Dr. Norvin Green, President of the Western Union Telegraph Company, died quite unexpectedly at his home in Louisville, Ky., last month. Dr. Green had been a conspicuous and prominent figure in the history of telegraphy from the first, having been interested in it at the time that Morse was first building lines. He started in a small way. Soon after the Western Union Company began to absorb other corporations he became connected with the company and for several years was president.

Adjustable Electrolier.

The accompanying illustration represents something new in the line of an adjuster for raising or lowering incandescent lamps suspended on cords. It differs essentially from other devices for this purpose in the fact that the regulating device is attached permanently to the ceiling, taking the place of a ceiling rosette or cutout. The cord is therefore not rendered clumsy by a heavy adjusting ball, and the movement up and down is more readily controlled and more certain. In appearance the adjustable electrolier is very neat resembling a polished brass canopy. The Electric Appliance Company, Chicago, is looking after the interests of this new device in the west.



ARC LAMPS FOR INCANDESCENT CIRCUITS.

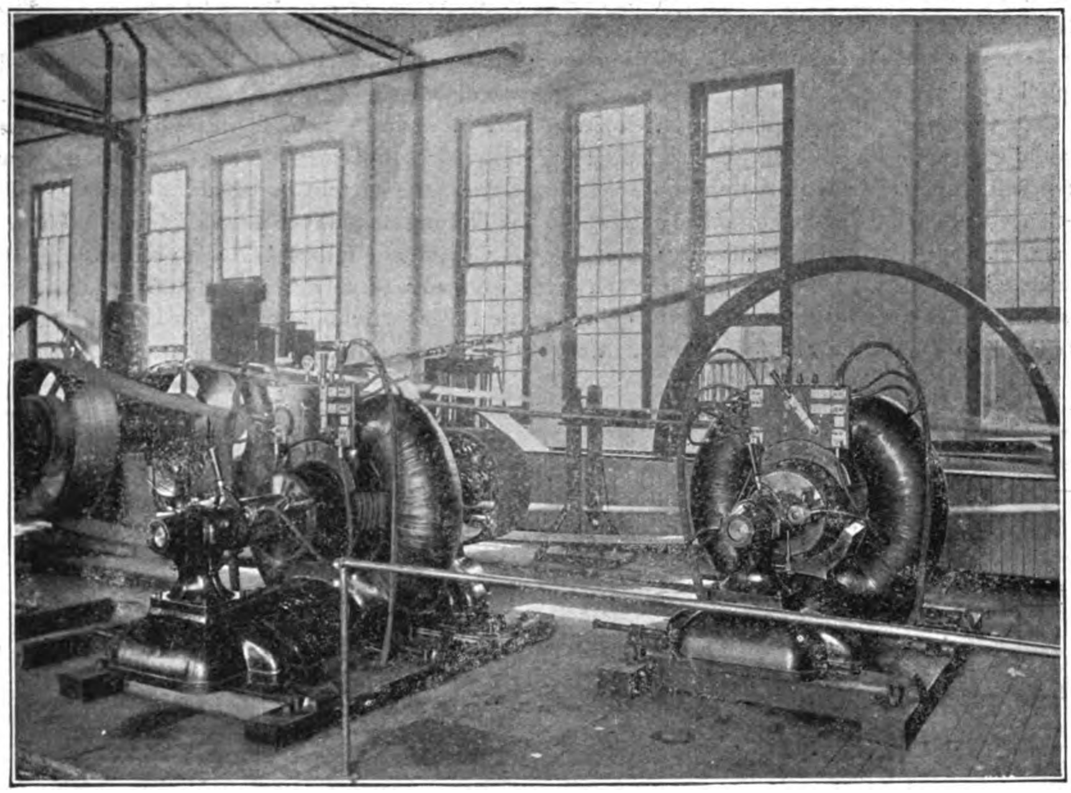


ADJUSTABLE ELECTROLIER.

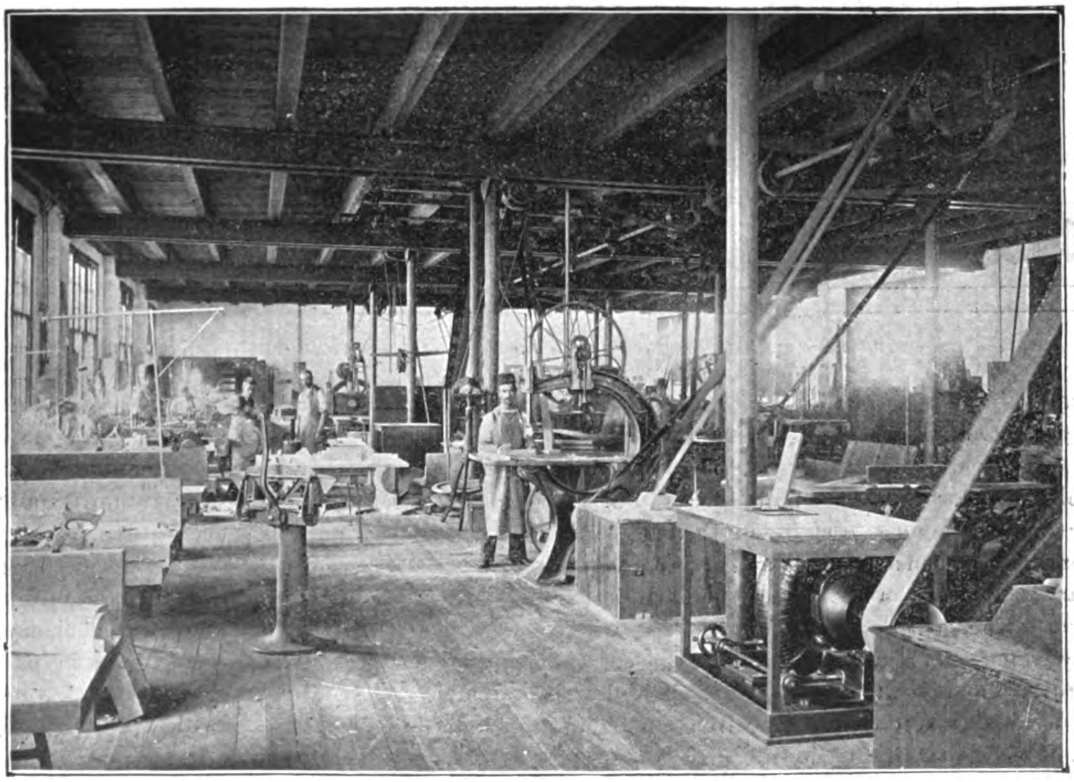
Power Transmission by Electric Motors in the Fraser & Chalmers' Plant.

During the past two or three years a number of small electric motor installations have been made for the transmission of power in manufacturing or other establishments where power is required, but in none of these instances has electric transmission by means of motors been carried out to the extent to which it has recently been in the new works of Fraser & Chalmers, Chicago.

This company is now operating the large plant shown in the accompanying illustration. The engine and dynamo room, the shafting shop, the pattern shop, the pattern storage building, the foundry and the boiler shop are all completed and in operation. In order to supply



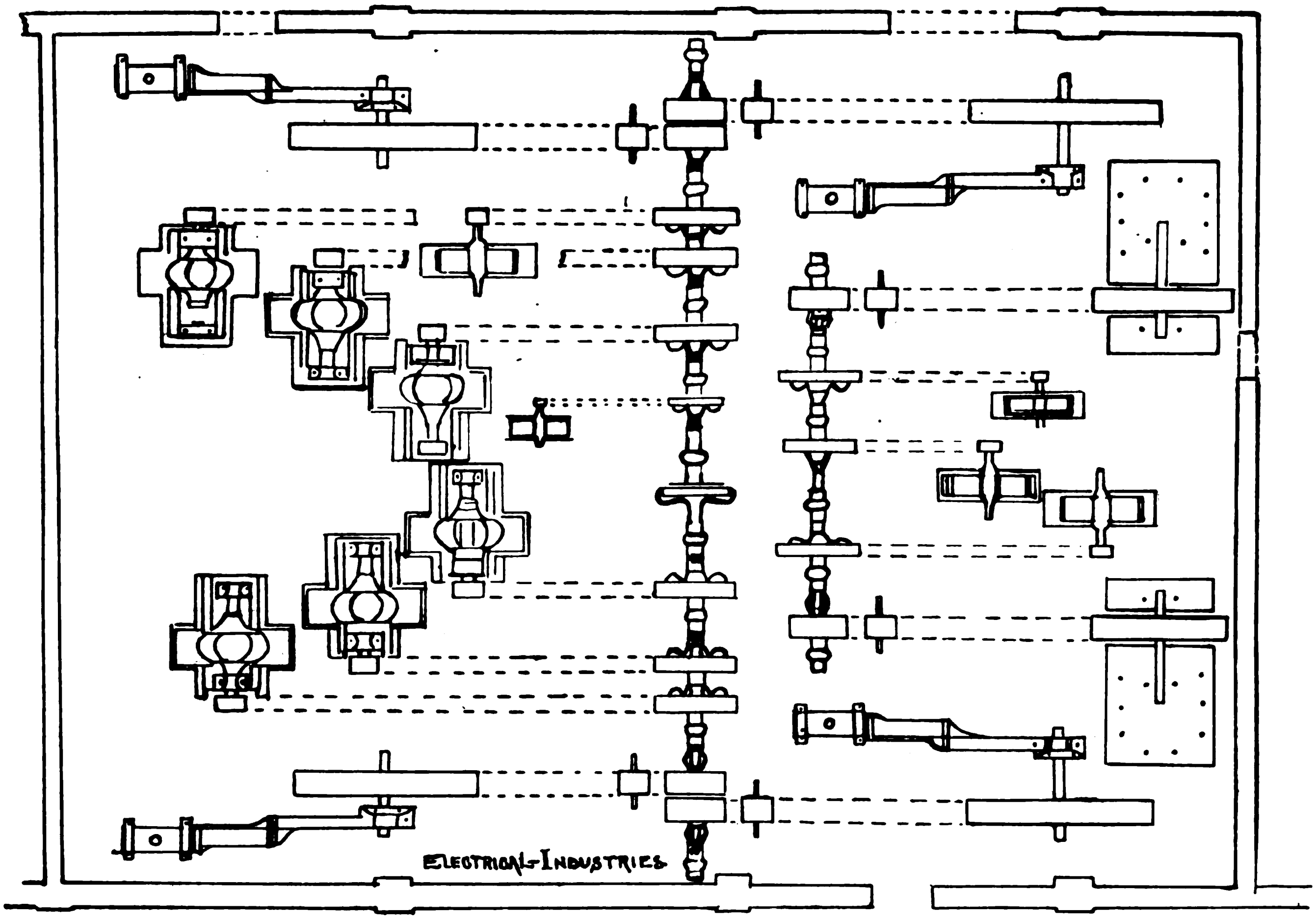
DYNAMO ROOM.—FRASER & CHALMERS' PLANT.



PATTERN SHOP.—FRASER & CHALMERS' PLANT.

the power for this plant and to transmit it with the most economy and efficiency the merits of electric transmission were carefully studied, and, after a close competition, a contract was made with the C. & C. Electric Motor Company, New York, to install an electric motor plant. The work of installing the plant was completed some six months ago, and after being fully tested under all conditions it has been accepted by Fraser & Chalmers. It is showing the efficiency that the most sanguine friends of electric transmission could well hope for, as it has been adapted to all purposes for which power is required and no trouble has been experienced in caring for and operating it.

The wiring was thoroughly done and the wires in every instance are removed as far as possible from the reach of meddling hands. Every precaution possible has been taken to secure the best insulation and to provide against injury to the mains or to employes. Each motor is covered and protected on all sides by a substantial box which can be taken apart so that the motor may be easily reached for oiling, inspection or repair. On top of the box directly over the commutator is a glass through which most of the working parts can be seen without opening the lid.

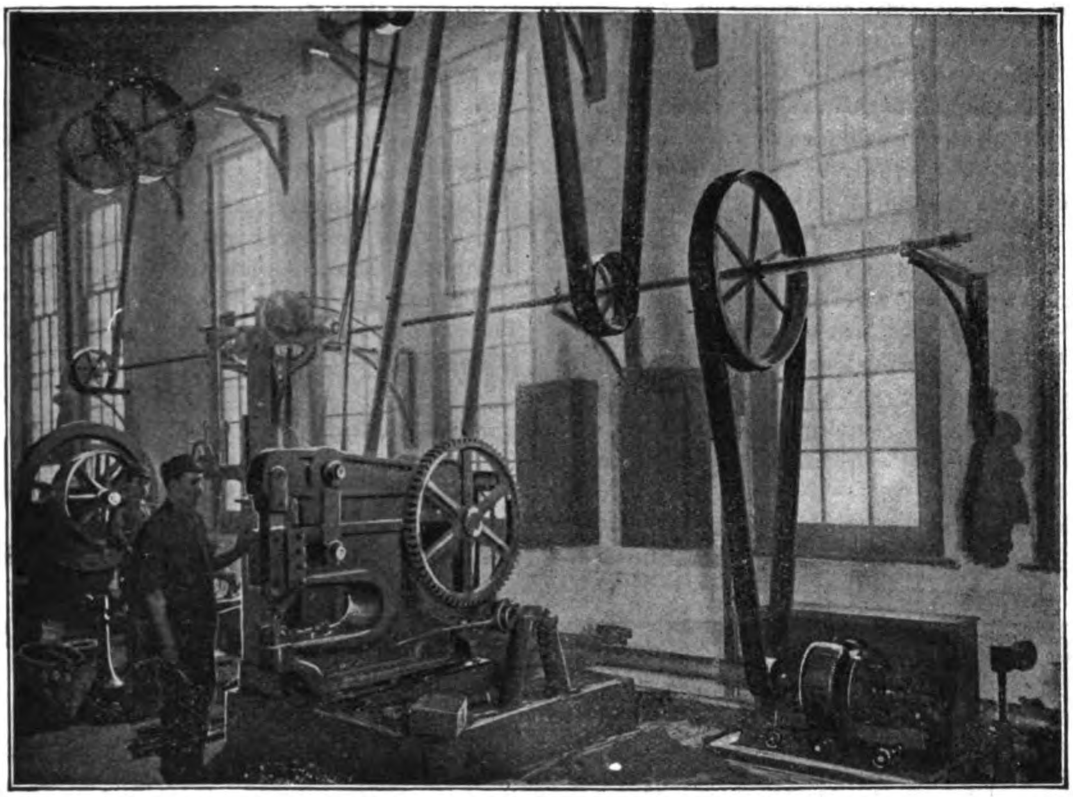


GROUND FLOOR PLAN OF DYNAMO ROOM.—FRASER & CHALMERS' PLANT.

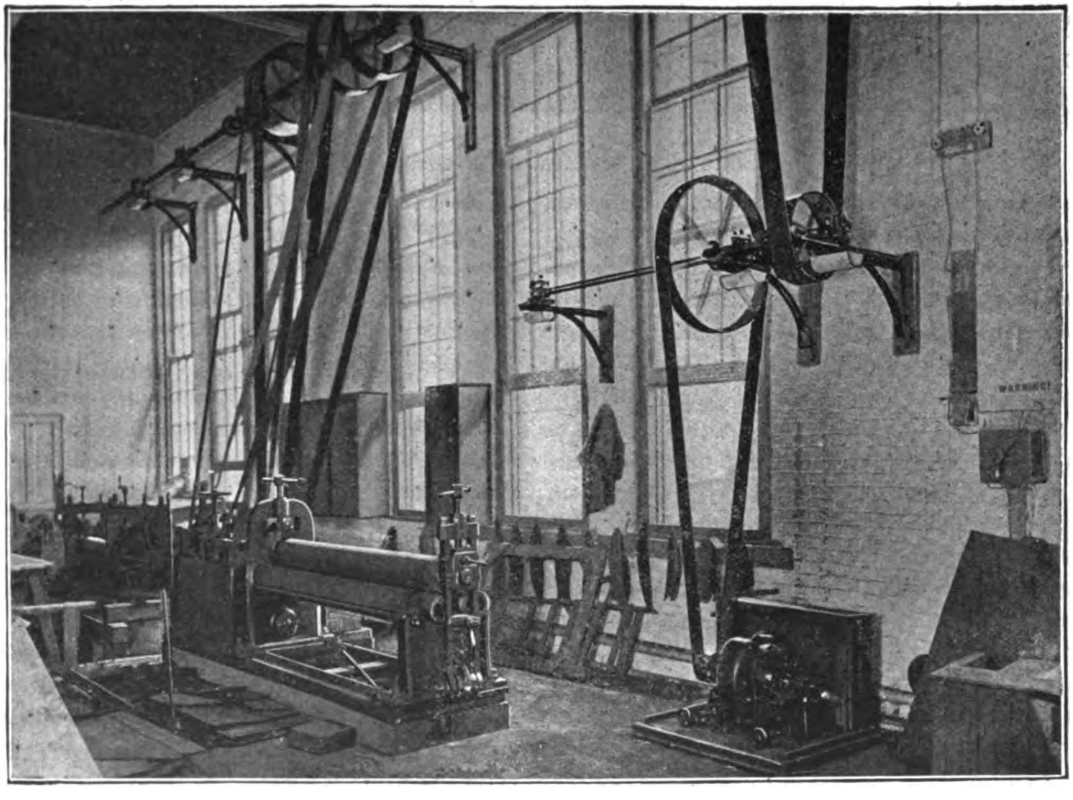
It is an instructive lesson in the transmission of electric power to begin in the dynamo room of this plant where the electricity is generated, and then follow the current through the three departments in which it is utilized and study each individual installation. The dynamo equipment consists of two C. & C. 80 kilowatt generators, one Western Electric 75 kilowatt generator, one Western Electric 50-light high tension arc dynamo and one Thomson-Houston 40 kilowatt generator. The two C. & C. generators now furnish all the current that is required to operate the several motor installations for operating machinery. This current is 250 volts. The Western Electric generator has only recently been installed and is not yet in use. The arc dynamo, although of 50 lights capacity, has 53 lights on the circuit. These lamps are full arc, eleven being in the pattern shop, twenty in the foundry, sixteen in the boiler shop, four in the power house and two on poles outside. About 200 incandescent lamps are also used. These are operated on the power circuits, five in series. The Thomson-Houston generator is used only for supplying current for the motors on the electric cranes, the current being of 220 volts.

The engine plant consists of two 200-horse power Fraser & Chalmers engines belted to a line of shafting which is provided with a friction clutch for each generator. There are three switchboards. The one used in connection with the Thomson-Houston generator is compactly arranged with lightning arresters, switches, ammeters, voltmeters, rheostat, etc. Two circuits are run from it, one to the boiler shop, the other to the foundry. The switchboard in connection with the power tranmission is much larger and is very complete in its equipment. It is made of slabs of slate in a strong oaken frame. All connections and wiring are on the back and every precaution possible has been taken to secure the greatest efficiency. The three power generators are designed to run in parallel. Three circuits are operated from this board, one each to the foundry, the pattern shop and the boiler shop. This board is fully provided with all the necessary instruments, fuses, etc. The foundry circuit carries a current of 360 amperes, the boiler shop 160 amperes and the pattern shop 120 amperes. The switchboard for the arc lighting plant is as yet only a temporary one. The wire used in the installation of this plant is Habershaw and Okonite.

Adjacent to the dynamo room is the foundry in which installations of motors are made as follows: the 30-ton crane manufactured by the Morgan Engineering Company, Alliance, O., is operated by three Thomson-Houston motors, the hoist motor being of the R 30 type, the bridge R 20 and the trolley R 6. At one end of the foundry is a large apparatus for heating, consisting of a Sturtevant blower operated by a 25-horse power Sprague motor which exceeds its rated capacity by two or three-horse power continually. The following are all C. & C installations: One motor of ten-horse power capacity runs a circular saw, a jig saw and a grind stone; one sixty-five horse power motor runs a Root blower in connection with the cupola; one twenty-horse power motor runs the foundry elevator which readily hoists two tons; one reversible five-horse power motor runs cars in and out of the core ovens; a



TEN H. P. MOTOR RUNNING SHEAR DRILL AND PUNCH.—FRASER & CHALMERS' PLANT.



FIVE H. P. MOTOR RUNNING TWO SETS OF ROLLS AND A PUNCH—FRASER & CHALMERS' PLANT.

one-horse power motor in the core room runs a sand sifter two two-horse power motors are operated in the cleaning room, one of which runs two emery wheels, the other casting cleaners. In the blacksmith shop one five-horse power motor runs a Root boiler. Another motor of three-horse power runs a cinder barrel for shaking cinders while an eight ton jib crane is operated by two motors, one of seven and one-half and another of five-horse power.

In the pattern shop considerable wood working machinery is operated and this wholly by electric motors. On the first floor is a ten-horse power C. & C. motor which runs a Sturtevant blower for purpose of heating; On the second floor one twenty-five horse power motor runs a line of shafting about 150 feet long from which are run four wood turning lathes, two band saws, one jointer one circular saw and a grindstone. Another motor of twenty-horse power capacity runs a large jointer and a circular saw. The only other motor in connection with this department is one of fifteen-horse power which operates the elevator.

In the boiler shop are the following installations: One twenty-five horse power Sprague motor runs a Sturtevant blower in connection with heating apparatus; a three-horse power Sturtevant blower is operated by a Sturtevant motor in connection with the forges. The fifteen-ton electric crane is operated by three Thomson-Houston motors the hoist motor being of the R 20 type, the bridge of the R 20 and the trolley of the R 6. The C. & C. motor installations in this shop are as follows: one ten-horse power motor runs one set of ten foot boiler plate rolls, and a twenty foot plate planer; one ten-horse power motor runs one punch, shears and two drill presses; one ten-horse power motor runs one punch and a drill press; one ten-horse power motor runs a very large punch for the heaviest kinds of work; one five-horse power motor runs two smaller punches and a drill press; one five-horse power motor runs two boiler plate rolls, a lathe, one shaper and a punch; one ten-horse power motor runs a large shaping machine; one five-horse power motor runs two shears and one five-horse power motor runs a Root blower.

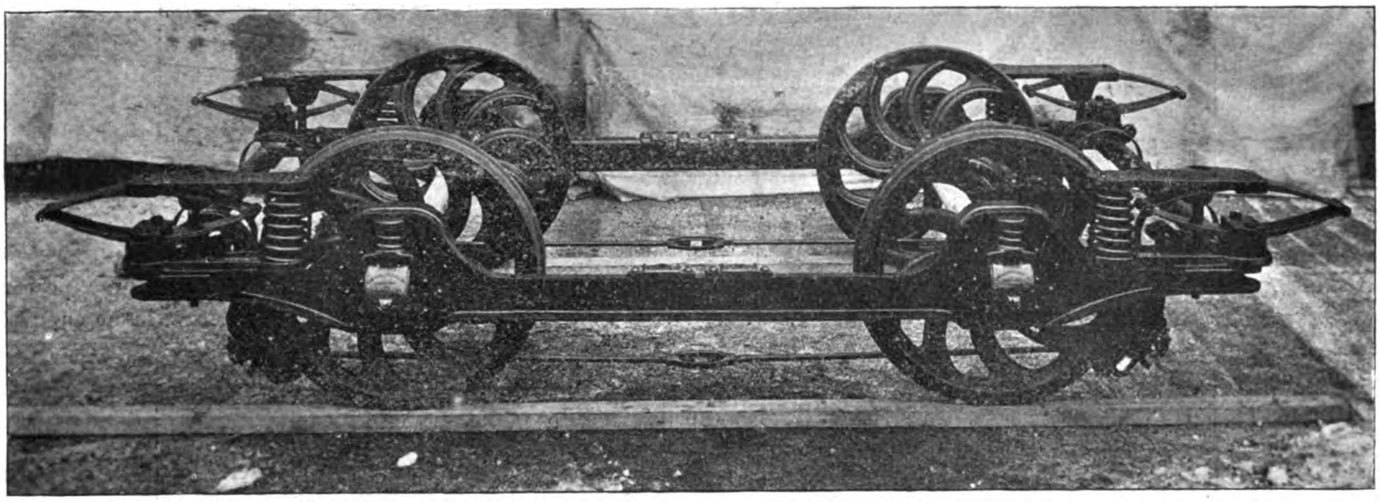
In the engine house is another motor installation consisting of one ten-horse power Thomson-Houston motor which operates a derrick in the yard for purposes of loading and unloading cars.

The efficiency of electric cranes in connection with heavy work could not be more clearly demonstrated than it is done in the boiler shop and in the foundry of this establishment. Flat cars from the adjoining railroad tracks are run into the building and the electric crane readily handles the heaviest pieces of work, taking them from any part of the building and depositing them on the car exactly where they are wanted.

As at present constituted the motor installation in this establishment comprises thirty-four motors. Of this number twenty-four are of the C. & C. make, there being eleven in the foundry aggregating 125½-horse power, nine in the boiler shop aggregating seventy-horse power, and four in the pattern shop aggregating seventy-horse power, a total of 265½-horse power. Then there are seven Thomson-Houston motors, two Sprague motors and one Sturtevant.

The McGuire "Columbian" Electric Truck.

Beginning with the year 1893 the McGuire Manufacturing Company, 122–132 North Sangamon St., Chicago, has been putting on the market a new design of electric truck called the "Columbian," as illustrated herewith As will be seen there are eight spiral springs which cushion the truck frame on the journal boxes. This construction reduces the hammering on the rails and consequently prolongs the life of the motors and car bodies. It prevents pounding when crossing railroad tracks, and by means of two sets of springs prevents oscillation. This truck is constructed on the same general principles as all the wellk nown McGuire trucks and all trucks of this make can be readily converted into a "Columbian."



THE M'GUIRE "COLUMBIAN" ELECTRIC TRUCK.

An electric street railway which has just been constructed in England reduces to a minimum the amount of wiring in its overhead construction, and to a large extent does away with the "unsightliness" with which overhead construction is frequently accused. Elsewhere in our columns, this month, we publish a description of this new construction. In the United States we regard our electric railways as very successful, from both a mechanical and elctrical point of view, but there is acknowledged to be opportunity for improvement in their appearance, and any improvement in this respect which at the same time maintains the already acquired standard of efficiency, will be welcome.

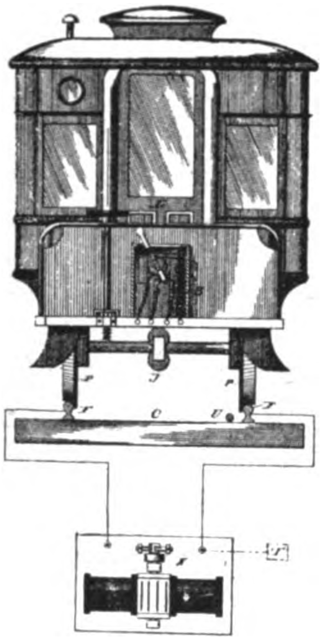
The Green and Field Electric Railway Patents.

The recent purchase of the Green electric railway patents by the General Electric Company was a significant movement on the part of this company to strengthen its position in the electric railway field, by securing apparently valuable foundation patents. Below, we give the text of these patents as granted:

THE GREEN PATENT FILED IN 1879.

1. The combination of a railway track; one or more stationary means of electric supply; electrical conductors extending from said means of electric supply along the line of said track, and consisting wholly or in part of the rails thereof; vehicles moving along said track; electro-dynamic motors, whose coils are constantly excited so long as the poles of said motor are in circuit with the means of electric supply fixed upon said vehicles for imparting motion thereto; and wheels supporting said vehicles upon the track, and also serving to maintain continuous electrical connection between said means of electrical supply and motors.

2. The combination substantially as set forth, of a railway track; one or more stationary electric batteries; electrical conductors extending from said batteries along the line of said track, and consisting wholly or in part of the rails thereof; vehicles moving along said track; electro dynamic motors whose coils are constantly excited so long as the poles of said motors are in circuit with the electric batteries fixed upon said vehicles for imparting motion thereto; and wheels supporting said vehicles upon the track, and also serving to maintain continuous electrical connection between said batteries and motors.



THE GREEN PATENT FILED IN 1886.

3. The combination substantially as set forth, of a railway track; one or more stationary means of electric supply; electrical conductors extending from said means of electrical supply along the line of said track, and consisting wholly or in part of the rails thereof; vehicles movable along said track; electro-dynamic motors fixed upon said vehicles for imparting motion thereto; and wheels supporting said vehicles on the track, and also serving to maintain continuous electrical connection between said means of electric supply and said motors.

4. The combination of a railway track; one or more stationary means of electric supply; electrical conductors extending from said means of electrical supply along the line of said track and consisting wholly or in part of the rails thereof; vehicles moving along said track; rotating electro-dynamic motors fixed upon said vehicles for imparting motion thereto, and wheels supporting said vehicles upon the track, and also serving to maintain continuous electrical connection between said means of electric supply and said rotating motors.

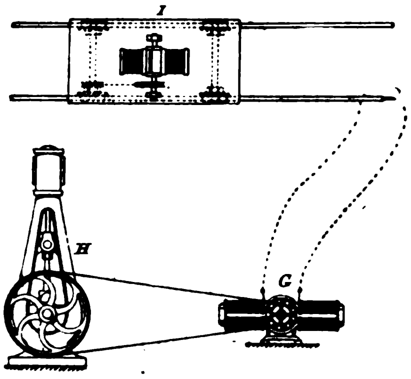
After this patent was filed Mr. Green sought to amend it and broaden the scope of it. This patent contained some very broad claims as will be seen by the text:

THE GREEN PATENT FILED IN 1886.

1. The combination of one or more stationary sources of electric current; a conducting circuit formed wholly or in part of an insulated line of rails of a railway track; a wheeled vehicle movable upon or along said line of rails; one or more rotating electric dynamic motors mounted upon said vehicle for propelling the same and included in said circuit of conductors; and a circuit controller placed on said vehicle and also included in said line of conductors.

2. The combination of one or more stationary sources of electric current; the conducting circuit formed wholly or in part of an insulated line of rails of a railway track; a wheeled vehicle movable upon or along said line of rails; one or more rotating electric dynamic motors whose coils are continuously excited so long as the poles of said motors are in circuit with the means of electric supply; mounted upon said vehicle for propelling the same and included in said circuit of conductors; and a circuit controller placed on said vehicle and also included in said line of conductors.

3. The combination of one or more sources of electric supply; a railway track; a wheeled vehicle moving upon or along said track; a conducting circuit composed wholly or in part of insulated conductors extending along the line of travel of said vehicle; one or more rotating electric motors mounted upon said vehicle for propelling the same and included in said circuit of conductors; and a circuit controller placed on said vehicle and also included in said circuit of conductors.



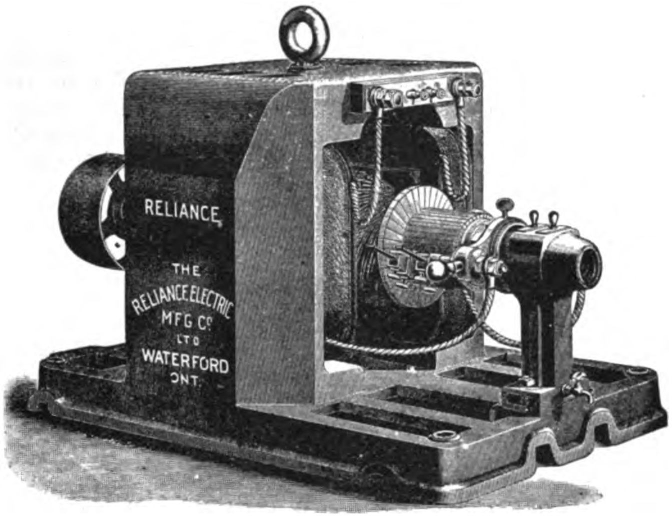
THE FIELD PATENT FILED IN 1880.

In this patent it will be noticed that Mr. Green mentions in his first claim the use of a source of electric energy—which may be a generator—a conducting circuit formed wholly or in part by the rails; a wheeled vehicle which depends for its power upon motors, and for its source of energy the rails, wholly or in part, while attached to the vehicle is a circuit controller. In the third claim the conducting circuit is composed "wholly or in part of insulated conductors extending along the line of travel of said vehicle." This may readily include the trolley wire. Were the courts to sustain these broad claims, it is evident that an electric railway which uses a generating plant transmits its electricity from this plant by means of trolley or feeder wires, to excite the coils of motors, which operate the cars, and uses a controlling device on the car connected with the circuit to control the supply of electricity; thus it infringes upon this patent. This patent is broader than the first patent granted to Mr. Green, as it can be interpreted to cover the trolley system and thus make every electric railway in the country, with one or two exceptions, an infringer. The important feature in the 1879 patent is in the first claim for "one or more stationary means of electric supply." If this can be interpreted to mean a generator the two Green patents cover the whole system of electric traction as now practiced. The 1886 patent has been in a measure adjudicated by the patent office, but whether the courts will sustain the patents is yet to be seen.

But before the second Green patent was filed the Field patent had been presented at the patent office, and although there is nothing in this patent that can be interpreted to include the trolley it claims the use of an electric generator as a source of energy to operate electric motors on the cars. The text of this patent as granted is as follows:

THE FIELD PATENT FILED IN 1880.

Claim 1. The combination of a stationary dynamo-electric generator driven by a suitable motor; a circuit of conductors composed in part of an insulated or detached section of the line of rails of a railroad track; a wheeled vehicle movable upno or along said insulated section of track; an electro magnetic motor mounted upon said vehicle for propelling the same and included in said circuit of conductors; and a circuit controlling device placed upon said vehicle.



RELIANCE ELECTRIC MACHINES.

2. The combination as substantially hereinbefore set forth of a railway carriage or vehicle propelled by an electro-magnetic motor mounted thereon; with a continuous hollow chamber enclosing an insulated electric conductor and provided with a longitudinal slot to permit the entrance of an arm projecting from said carriage so as to form a traveling electric connection with said insulated conductor.

3. The combination substantially as hereinbefore set forth of a wheeled carriage or vehicle, and electro magnetic motor mounted thereon, and a yielding or frictional mechanical connection between the driving-wheels of said vehicle and the electro-motor.

The Field patent has not been adjudicated as yet, but the owners of it have brought suit for infringement against the Jamaica & Brooklyn Railroad Company, and as this road operates General Electric apparatus, the courts will soon be called on to decide upon the validity of the patents.

The United States Government has brought suit against the American Bell Telephone Company to make void the Berliner microphone patent on the ground that it was obtained by means of false suggestion and concealment. This patent, it will be remembered was filed June 4th, 1877. Three years later substitute specifications were filed and the granting of the patent was delayed from one reason and another until November 17, 1891.

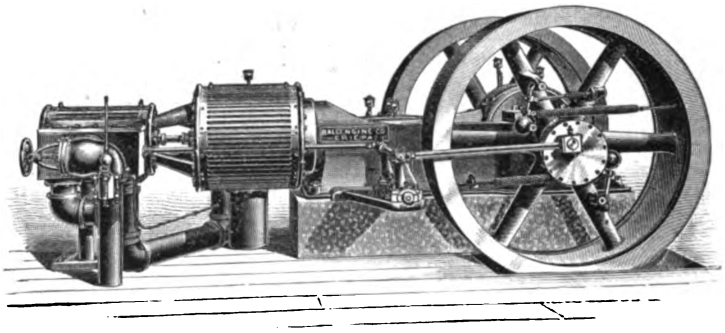
One of the largest street railway deals yet made is reported as having taken place in New Jersey. A syndicate headed by J. D. Crimmins of New York, is said to have purchased lines aggregating 140 miles of track in Jersey City, Elizabeth, Newark, Orange and other adjoining cities and towns. The sections of these lines not already equipped electrically are to be so equipped at once.

Ball 400-Horse Power Tandem Compound Engine.

In the accompanying illustration is shown a type of engine that the Ball Engine Company, Erie, Pa., has recently designed for electric railway service. In this engine the stroke is made short for the purpose of raising the number of revolutions and reducing the wheel diameters, so as to more nearly approach the diameters of the generator pulleys. The range of wheel diameters is from 80 to 112 inches, which enables the engine to drive directly on to the pulleys of the different makes of generators without the intervention of line shafts or other devices for raising the lineal velocity of the belts.

The engine illustrated has 18-inch high pressure and 30-inch low pressure cylinders, with 18-inch stroke of pistons, carries two wheels of 96 inches diameter by 25 inches face, weighing 10,000 pounds each, giving a fly-wheel capacity and efficiency equivalent to more than double their weight if made into a 20-foot wheel for a 60-inch stroke engine, making under one-third as many revolutions.

The long distance telephone service was completed last month connecting Chicago and Boston. The circuit is operated in connection with the one put into service last October connecting New York and Chicago.



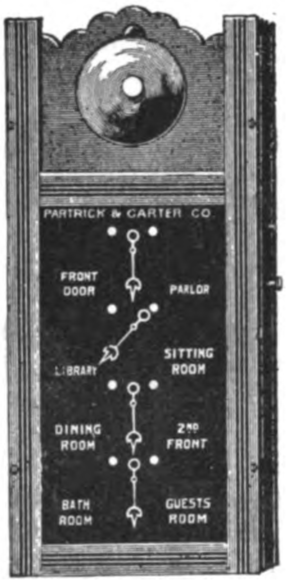
BALL 400 HORSE POWER TANDEM COMPOUND ENGINE.

Reliance Electric Machines.

The Reliance Electric Manufacturing Company, Ltd., Waterford, Ont., is just putting on the market a new design of dynamos and motors, the type of which is shown in the accompanying illustration. This construction was chosen in order that the machine might be of reasonable cost, that it should have economy of power and maintenance, be durable and yet simple in construction and action. These machines have been used in a quiet way and have proved so satisfactory that they are now being brought into more prominence. They are of the iron clad type. The entire frame and bearing supports are in one casting and there are no joints to introduce resistance in the magnetic circuit. The field magnets are brought as close to the armature as possible with the purpose of making a complete utilization of all the lines of force. The bearings are self oiling and self aligning. It will be noticed that the commutator is of ample length and diameter. In these machines the armature shaft is placed low, and the bed plate is wide. The armature can be readily removed, and the magnet coils slipped off with little trouble.

Automatic Set-Back Annunciator.

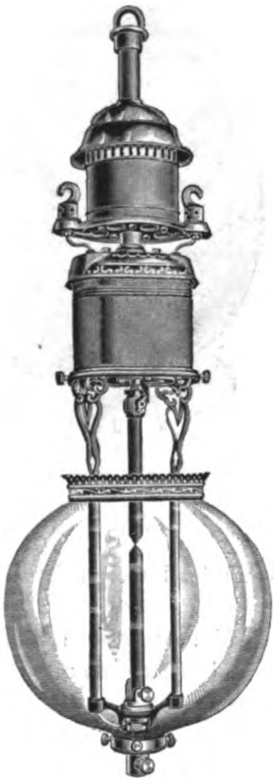
The Partrick & Carter Company, 125 South Second street, Philadelphia, has perfected an automatic system in which only one and that the last call remains pointing or indicating. Each new call resets the pointer that indicated the previous call. Thus this annunciator requires no attention further than observing the dial when a call comes. The appearance of this annunciator is the same as the well-known "King" manufactured by this company. This new annunciator is shown in the accompanying illustration. It is known as the new automatic set-back annunciator, and is made in all styles and sizes for all purposes.



AUTOMATIC SET BACK ANNUNCIATOR.

The Kester-Atwood Arc Lamp.

The accompanying illustration shows the Kester-Atwood arc lamp, which is just being put on the market by the A. H. Atwood Electric & Manufacturing Company, 166-174 South Clinton St., Chicago. The particular point claimed for this lamp is economy in the consumption of current. No cast iron in any shape whatever is used in the lamp, the entire frame and mechanism being of steel and bronze metal. As will be seen from the cut the lamp is attractive in form. The parts are all highly finished and heavily lacquered. The lamp is designed to be used in connection with any system of electric lighting on low tension circuits, and it is made in various candle powers, from 500 up.



KESTER ATWOOD ARC LAMP

New Baxter Railway Motor.

The new Baxter railway motor, which is shown in the accompanying cuts, embodies many improvements. On of the difficulties with electric railways is the rapid deterioration of the track joints, due to the heavy dead weight of the motors hanging upon the axles. In this motor this trouble has been minimized by making the machine as light as possible, and also by so constructing the suspension that the motor, instead of hanging, virtually

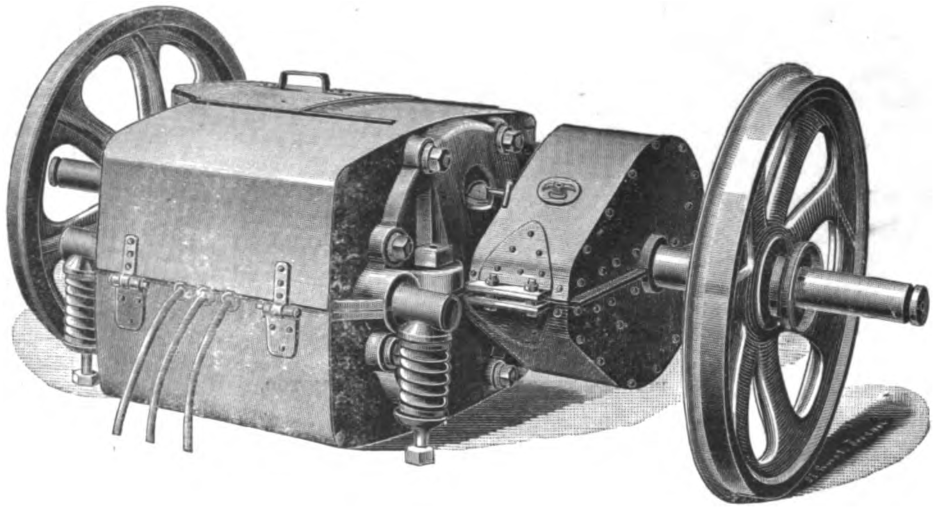


FIG. 1.—NEW BAXTER RAILWAY MOTOR.

rests upon it. In this way the axle is greatly relieved of dead weight, as a considerable more than half the machine is carried upon the suspension. This not only saves rail joints from the effect of the hammering blow of the wheels, but also reduces the tendency of crystalization of the wheels and axles. The lightness of the motors in addition to saving the track and wheels, is a further advantage as it reduces the dead weight by about one ton, and saves the coal.

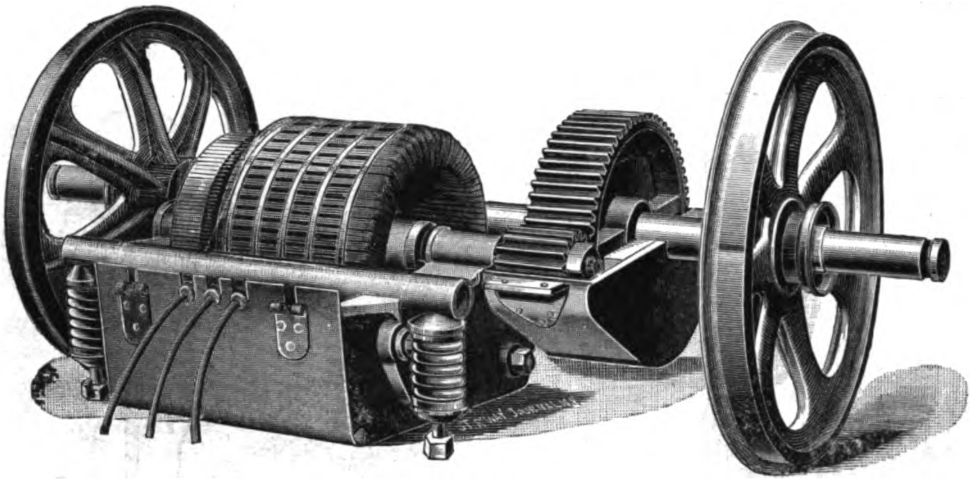


FIG. 2.—NEW BAXTER RAILWAY MOTOR.

Another feature of importance in this motor, is that it is extremely small and can be mounted on thirty-inch car wheels, and still leave a space of five and one-half inches between the lowest point of the motor and the track. The space required between the car floor and the center of axle can also be made from three to four inches less than that required by the general run of motors, therefore, the step of the car can be lowered fully six inches, the advantage of which railway men will readily appreciate. The method of suspending this motor deserves special notice. Instead of depending on a cast iron lug attached to the extreme rear end of the machine, a strong wrought iron tube is passed through the body of the motor, and extends out at each side where it is supported in strong steel springs resting upon the suspension bars of the truck.

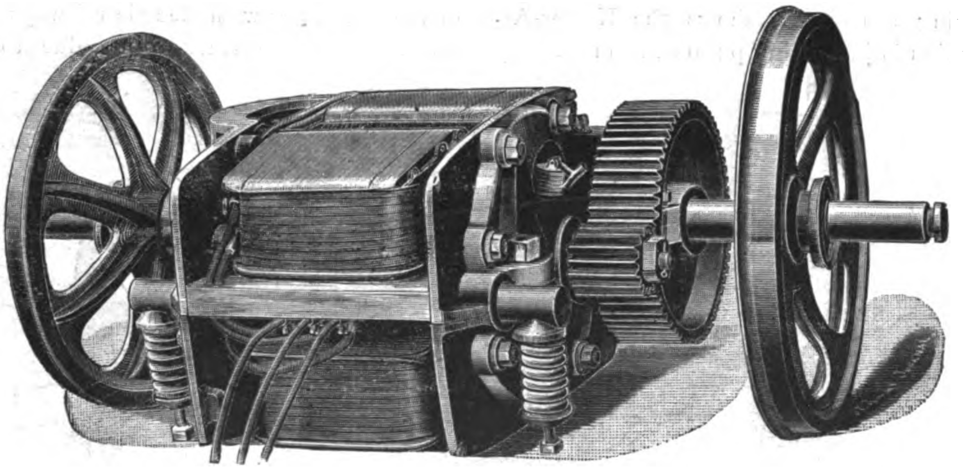


FIG. 3.—NEW BAXTER RAILWAY MOTOR.

Another feature of importance, in climates where tracks are often covered with slush and mud in winter, is that the motor is enclosed in a perfectly water tight casing, and can be run with impunity in the wettest of weather without danger of burning out the fields. The magnetic circuit of the machine is made of wrought iron. This together with the fact that the cross section is very great, makes it possible to attain a very high efficiency, and on account of the high cross section of the magnetic field, it is not necessary to magnetize the iron to anything like saturation when working with moderately heavy loads, therefore the reserve power is very great, so great indeed, that a truck equipped with two 25-horse power motors can in an emergency develop a horizontal pull of from 6,000 to 7,000 pounds, and can maintain a pull of about 3,500 pounds all day without undue heating.

The operating switches are of the well-known platform cylindrical type, but for the material of the cylinders, instead of wood, a composition that is fire and waterproof is used. The contact plates are provided with removable tips, which may be replaced when worn out. Two types of switches are manufactured for use with these motors, one to operate with a rheostat and the other for the series parallel system of control. In the latter style, the Baxter company claims to have overcome any objectionable jumping on the third notch by interposing two additional steps between the series and the parallel connections, and thus reduce the violent changes from a series to the parallel by dividing the change into three steps instead of one,

The Charles E. Gregory Company.

Probably the latest organization in the electrical field in Chicago is the Charles E. Gregory Company, which has just taken a lease of the large plant formerly occupied by the Bain Electric Manufacturing Company. The new company will continue the business formerly carried on by Mr. Charles E. Gregory in the handling of new and second hand electrical apparatus and will also manufacture a line of specialties. Mr. Gregory is one of the pioneers in the electrical business in Chicago. He was first manager of the Sun Electric Light Company, and was associated with the Merchants Arc Light & Power Company, the Sperry Electric Company, the Standard Electric Company, the Hyde Park Electric Light & Power Company, all of which were allied interests. Mr. Gregory will be president of the new company that he has organized, and will also continue as a member of the firm of Johnston & Gregory, which operates an electric light plant.

ELECTRIC LIGHT AND POWER.

EXTENSIONS AND IMPROVEMENTS.

Aledo, Ill.—The Aledo Electric Light & Power Company will install a larger incandescent dynamo in place of its present one and make other improvements. Vincent & Lair are proprietors of the plant.

Seymour, Conn.—The stockholders of the Seymour Electric Light Company have voted to increase the capital stock to $28,000, and the new stock has all been taken. The capacity of the plant will be increased by the addition of a 1,000-light incandescent dynamo and other extensions.

Mattoon, Ill.—The Mattoon Electric Light Company contemplates increasing its lighting capacity soon. J. F. Marks is manager.

Vallejo, Cal.—The Vallejo Electric Light & Power Company contemplates installing a 1,000-light alternating dynamo soon. James R. Petrie is manager.

Mt. Pulaski, Ill.—I. H. Snyder will install a 125-horse power engine in his electric light plant.

Independence, Iowa.—The Independence Gas & Electric Company has succeeded the Independence Electric Light Company, having purchased its franchise and plant.

Florence, Ala.—The Florence Gas Electric Light & Power Company has sold its plant and franchise to Campbell & Company. It is proposed to operate the plant by water power, and the change will be made soon. G. W. Swartz is manager and purchasing agent.

Kentville, Nova Scotia.—The Kentville Electric Light & Power Company contemplates increasing its lighting capacity some time this year. Cyrus Baird is superintendent.

Hastings, Mich.—The Hastings Electric Light & Power Company will double the capacity of its plant. L. B. Bentley is manager and purchasing agent.

Calais, Me.—The St. Croix Gas Light Company will increase its number of arc lamps and extend its incandescent lighting facilities. Frank Davis is manager and purchasing agent.

Constantine, Mich.—The Constantine Electric Company is making plans to extend and increase its lighting facilities this spring. John J. Proudfit is purchasing agent.

Colchester, Ill.—The Colchester Electric Light & Power Company will increase its capital stock preparatory to making improvements and extensions. Henry Terrill is secretary and purchasing agent.

Momence, Ill.—The Momence Electric Light Company will overhaul its whole system preparatory to doubling its lighting capacity. L. W. Calkins is manager and purchasing agent.

Madison, N. J.—The municipal plant will have its facilities increased by the addition of a 200-horse power engine, two boilers, and a 2,000-light alternating dynamo. The lighting circuits will also be extended. F. E. Day is manager.

Longmont, Colo.—The Longmont Electric Light & Power Company is installing a 500-light Westinghouse alternating dynamo and will make other improvements. C. M. McCarney is manager and purchasing agent.

Opelika, Ala.—The Opelika Electric Light & Power Company will add to its equipment a 1,000-light alternator. J. A. Lyon is manager and purchasing agent.

Carbondale, Ill.—The Carbondale Electric Company will add another boiler to its power plant. R. D. Bradberry is superintendent.

Centerville, Ia.—The Centerville Light, Heat & Power Company, which now operates an arc plant, contemplates installing an incandescent system. Wm. Peatman is purchasing agent.

Cedar Falls, Ia.—The Cedar Falls Electric Light & Power Plant contemplates adding to its equipment, two dynamos, an engine and another boiler. B. L. Wilder is manager and purchasin agent.

Little Falls, Minn.—The Little Falls Electric & Water Company is installing two 1,000-light dynamos and will increase its arc lighting capacity soon. J. A. Berkey is president.

Fairfield, Ia.—The municipal plant, which now operates an arc system, contemplates installing an incandescent plant soon. T. F. Higley is superintendent.

New Organizations.

Quakertown, Pa.—A municipal lighting plant, operating both arc and incandescent systems has just gone into operation here. Gottlieb Frey is manager and purchasing agent.

Chester, Ill.—The Chester Light, Water & Ice Company has been organized to establish an electric light plant. Both arc and incandescent circuits will be operated. Power and other equipment have not as yet been contracted for. J. D. Gerlach is manager and purchasing agent.

Derry Station, Pa.—The Derry Electric Light Company has just put into operation, a plant having both arc and incandescent systems. Warner Utts is manager and purchasing agent.

Canadian Factory for Building McGuire Trucks

The McGuire Manufacturing Company of Chicago has established a Canadian branch at St. Catherines, Ont, where it will manufacture all the specialties of this company, and particularly the well known McGuire trucks for electric railway service. All the different styles of trucks manufactured by this company at the Chicago factory will be made in this new factory. By establishing this branch the McGuire company saves the duty of 35 per cent imposed on American-built trucks, and at the same time is in closer relation with the Canadian trade. A large order for trucks has already been received from the Niagara Falls & River Railway Company of Niagara Falls, Ont, These trucks will be built at the new works.

The *Electrical Worker*, Vol. I., No. 1, is a late arrival in electrical journalism, the first issue being the January number. It is the official organ of the National Brotherhood Electrical Workers of America, and is published at St. Louis.

The city of Marshall, Mich., has purchased the splendid water power at that point, and is installing an electric lighting plant which is to be of the most improved construction and will be used for public lighting purposes. Power will be rented to manufacturers for use during the day. This will prove an economical arrangement, both for the city and those using the power.

PERSONAL.

Mr. E. W. Little, general manager of the Interior Conduit & Insulation Company of New York, was in Chicago last month.

Mr. H. D. Ames, formerly connected with Taylor, Goodhue & Ames, has severed his connection with that company to accept a responsible position with the Knapp Electrical Works, Chicago.

Mr. F. S. Carter, of the Partrick & Carter Company, Philadelphia, recently paid Chicago a visit in connection with some business matters in which his firm is interested. Mr. Carter was impressed with the growth of the city since his last visit, and was especially pleased with the World's Fair buildings.

Captain John A. Grier who has long been known in electrical circles, has recently become associated with The Ansonia Electric Company, (formerly The Electrical Supply Company) and is at present at its factory in Philadelphia, where he is familiarizing himself in every detail with the Helios Arc Lamp for alternating circuits, with a view of introducing it to the western trade.

The Ansonia Electric Company.

The Electrical Supply Company, which has been so widely known in electrical circles since the earliest days of electrical progress has changed its name to that of the Ansonia Electric Company. For some years this name was quite distinctive but of late nearly every city, large and small, has its electrical supply company, thus causing more or less confusion in names.

The idea has been considered for some months of making this change but the company has hesitated doing it because of the value in the name, but the new one seems in every way more appropriate than the old, not alone from the fact that the main factories of the company are in Ansonia, Conn., but also because Ansonia is in many respects the birthplace of recent electrical advancement. It was here that the first dynamo was built in this country, here it was too that the first electric light was used commercially, and it was here that Mr. Edison is said to have received his inspiration that resulted in the invention of the incandescent lamp. The only dynamo that was exhibited at the Centennial exhibition was one built in Ansonia. Altogether the change of name seems quite appropriate and as there is no change in the personnel of the company the name of the Ansonia Electric Company will soon be as intimately identified with the electrical business of Chicago, the west, and the whole country, as that of the Electrical Supply Company has been.

BUSINESS NOTES.

The Bryant Electric Company, Bridgeport, Conn., announces that Mr. W. B. Cleveland has assigned the entire interest of the Cleveland switch, together with the tools, patents and moulds for making the switches and arc cut-outs, formerly manufactured and sold by the Forest City Electric Works.

The F. E. Belden Mica Mining Company, Boston, Mass., has removed from 28 School St., to much more ample quarters at 12 Broad St., near State St. The business of this company has so increased of late that larger facilities for handling goods were necessary and in the new quarters every convenience is at hand.

The Enterprise Electric Company, 307 Dearborn street, Chicago, reports that its local business has increased to such an extent, that it has been necessary to increase its delivery service, and for this purpose it has purchased a complete delivery outfit. The company will now do its own delivering, and can guarantee prompt service.

The Robinson Machine Company, Altoona, Pa., is reported working over time to keep up with orders. The truck which this company is manufacturing has met with much favor and orders are being received from all parts of the country. One of the latest flattering orders was for 30 or more trucks from the Philadelphia Traction Company.

The Massachusetts Chemical Company, Boston, Mass., feels much gratified at the many testimonials it is receiving from users of Insullac, the new insulating material which has recently been put on the market. The Hamilton Electric Light & Power Company, Hamilton, Ont., uses Insullac for all sorts of repairs and speaks of its efficiency in the highest terms.

The Illinois Electrical Forging Company has been incorporated with a capital of $2,000,000. Walter G. Campbell of San Francisco is president, L. Kneeland vice-president and John P. Skinner of New York secretary and treasurer. The offices will be in the Title & Trust Building, No. 100 Washington St., Chicago. The company will do all kinds of electrical forging, smelting and welding and its factories will be located at West Pullman.

Eugene Munsell & Co., 218 Water St., New York, have become sole agents for the new insulating material, Micanite, which has attracted so much attention of late. The exhaustive paper read by E. P. Thompson, before the American Institute of Electrical Engineers, descriptive of this material, has been republished in pamphlet form, and copies can be had upon application to this firm. A standard price list of the electrical mica, which this firm makes a specialty of, has also just been published.

The Hoppes Manufacturing Company, Springfield, O., has had an important decision rendered in its favor by the United States Circuit Court in the case of S. N. Brown & Company vs the Stilwell & Bierce Manufacturing Company. This decision recognizes as distinct inventions the Berkshire and Hoppes patents for circulating devices for feed water heaters and purifiers. This includes the use of steam pipes which lead from the purifier to pump or other steam using device. The Hoppes company is distributing the full text of the decision among users of feed water heaters.

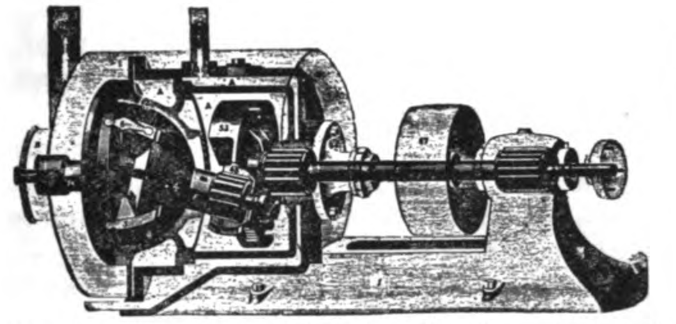
The Ansonia Electric Company, formerly the Electrical Supply Company, Chicago, has contracted for the western selling agency of the Helios Arc Lamp. It is a focusing lamp, and is constructed to successfully operate on an alternating circuit. It is the same lamp that is officially adopted by the German government, and although its introduction into this country dates back scarcely ninety days, its reception has been marked with evident approval, as over 5,000 have already been sold. With the celebrated Stanley Transformers, and the Helios Arc Lamp, the Ansonia Electric Company, certainly has a combination to win friends with central stations operating an alternating machine.

The Ball Engine Company, Erie, Pa., is selling engines as rapidly as it can manufacture them. Among the recent sales for service in electric stations are the following:—Calumet Electric Street Railway, Chicago, four 300-horse power railway engines, cross compounded; Hammond (Ind.) Electric Street Railway, one 150-horse power steam plant complete; Elmwood (Ill.) Electric Light Company, one 150-horse power engine; Marengo (Ia.) Electric Light Company, one 100 horse power steam plant complete; Western Light & Power Company, Chicago, one 300-horse power engine; Englewood Electric Light Company, Chicago, one 500-horse power cross compound engine; Titusville (Pa.) Electric Light Company, two 150 horse power tandem compound engines; and the Logansport (Ind.) Electric Light & Power Company, one 150-horse power engine.

The Central Electric Company, 116–118 Franklin St., Chicago, is experiencing a very lively trade. Over 1,000,000 feet of Okonite wire was sold in a few days recently. A large order received by telegraph for 30 miles of weatherproof wire was shipped on the day of receipt as the company's storage facilities are now ample for supplying orders of any size. Washington carbons have become such a staple with the Central company that the factory manufacturing them is to have its capacity doubled. The rush of business is delaying the Central company in issuing its new catalogue, but the prospects now are that it will be ready for distribution by April 1st. Okonite wire has been specified for Congress hotel, the annex to the Auditorium hotel. This wire was selected purely upon its merits as an insulator, the Auditorium having had a varied experience with other wires, and a practical demonstration of the superior merits of the lasting qualities of Okonite.

The Railway Equipment Company, Pullman building, Chicago, is already rushed with orders for the coming season. Contracts have been closed during the last week for roads in Leavenworth, Kan.; Cincinnati, Ohio; Nashville, Tenn.; Pittsburgh, Pa.; Detroit, Mich.; San Antonio, Texas; Kansas City, Mo.; Michigan City Ind., and large orders have been received from contractors in all parts of the country. It seems to be understood that the Railway Equipment Company, as far as possible, furnishes only the very best and most reliable supplies. The Type "G" overhead material of its manufacture is recognized as being of high quality in point of strength, insulation and ease of adjustment and its use insures the best class of equipment. Some of the largest roads in the country and Canada are now equipped with this material. The company carries in stock at all times ready for immediate shipment, everything necessary for the complete equipment and maintenance of electric roads of all systems.

The Electric Appliance Company, 242 Madison St., Chicago, announces that it has taken the western agency for the celebrated "O. K." weatherproof house, line and feeder wires and will carry a large and complete stock in Chicago. The quality of the "O. K." products are too well known to call for any extended comment. The company reports that business is already beginning to open up on the Meston alternating current fan motor and that it has already closed a number of agency arrangements and entered some very large orders. The Meston motor is so well known that applications come in from every part of the country and the Electric Appliance Company plans to have a good live agency thoroughly established in every large town having an alternating plant before the fan season opens up. Orders and inquiries for the swinging Ball lightning arrester which are already commencing to come in indicate very plainly that station managers are wisely beginning to prepare for protection from spring storms. The Electric Appliance Company, who is the general western agent for this specialty, has put in a large stock in anticipation of a heavy demand this season.



The above illustration shows the working parts of the only steam engine worthy of being called **high speed.** It is known as the

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It has no competitors.

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1000 REVOLUTIONS and more, in small sizes, and proportionally fast in larger sizes.

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For high speed machinery it saves many shafts, counter-shafts, hangers, pulleys, belts, and great loss of power incidental to their use. Speed readily reduced for slow running machinery.

This Engine is

NOT A "ROTARY,"

as its piston does not revolve; runs standing on either end, or placed horizontally, equally well; is *wholly* self-contained. Takes up but little room.

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is very light, and has simple, effective reversing mechanism. Especially well adapted for high speed Launches and Yachts. Its position in bottom of boat is most favorable for ballast.

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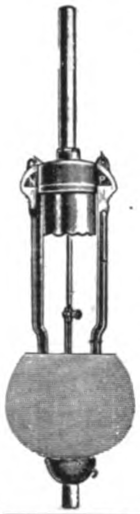

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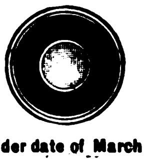
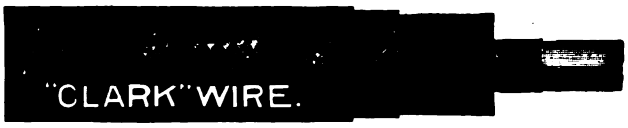




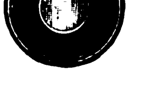
Insulation Guaranteed wherever used, Aerial, Underground or Submarine.

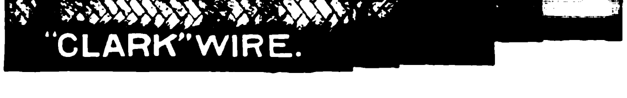
In a letter from the Inspector of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says: "A thoroughly reliable and desirable Wire in every respect.

The rubber used in insulating our wires and cables is especially chemically prepared, and is guaranteed to be waterproof, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, and special extra finish, which we have now adopted for all our solid wires as an extra weatherproof protection, and also preventing chafing and abrasion, which is water, acid and to a very great extent fireproof. Our insulation will prove durable when all others fail. We are prepared to furnish single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order. We are now prepared to furnish our Clark Wire with a white outside finish for ceiling cleat work as well as our standard color.

Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eights inch wide, and when wrapped around a joint and pressed firmly it makes a solid mass. **FOR RAILWAY** and **MOTOR** use, we make all sizes of stranded and flexible cables with Clark insulation.

WE GUARANTEE OUR INSULATION WHEREVER USED, AERIAL, UNDERGROUND OR SUBMARINE, and our net prices are as low, if not lower, than any other first-class Insulated Wire. We shall be pleased to mail Catalogue with terms and discounts for quantities.





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HENRY A. CLARK, Treasurer and Gen'l Manager.
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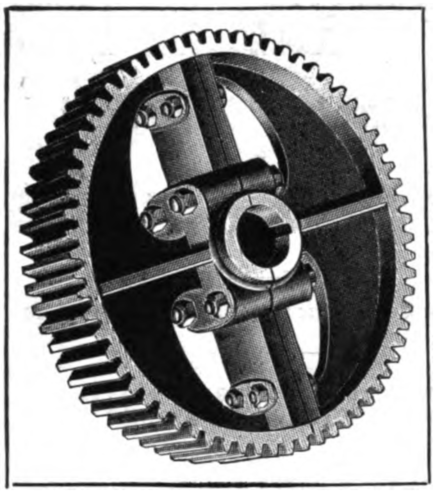

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For all Electric Railway Systems • GEARS made of Cast Iron, Steel or Rawhide ... PINIONS made of Steel, Bronze, Tempered Copper or Rawhide.

All our Gears and Pinions are made on the latest and most improved machinery. Our Castings are free from all imperfections.

ALL GEARS and Pinions are accurately cut and each one is given a most rigid test before leaving our works.

We are prepared to cut Gears for all systems, and of any desired diameter, pitch and face. Our Cast Steel Gears are unequalled.

Electric Railway Supplies for all Systems

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We carry a large stock of Okonite Weatherproof and Magnet Wire, Edison Lamps, Sockets, Cut-outs, Street Railway and Electric Light Supplies, Telegraph Instruments, Batteries, Bells, Construction Material, Pins, Brackets, Insulators, Etc., at lowest prices. Send for quotations.

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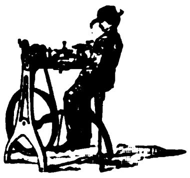

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GAP LATHE, $125.

Foot and Power Lathes, Drill Presses, Scroll-Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.

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THE Electrical Engineering and Supply CO.

134 EAST SIXTH STREET, OPP. HOTEL RYAN,
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THE CLARK COMPANY, NEW YORK
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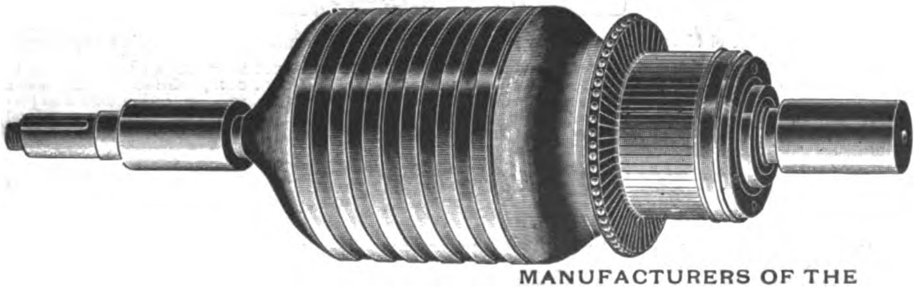
Is the only company in the United States that makes a specialty of manufacturing under own patents, Electric Arc Lighting Apparatus for every purpose, including the finest Arc Lamp in every respect, suitable for any class of interior lighting, with plain or ornamental fixtures, and can be used on incandescent circuits, on any voltage from 65 upwards, in series or single, or on arc circuits of standard current.

NOTE whether you are correctly reported in our directories; and if not, please send the necessary data at once.

THE STEEL MOTOR CO.

SUCCESSORS TO
JOHNSON ELECTRIC CO.



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NEW PERFECT STEEL CLAD MOTOR, - CLEVELAND, OHIO. U. S. A

ELECTRIC TRUCKS

M'GUIRE MANUFACTURING CO.

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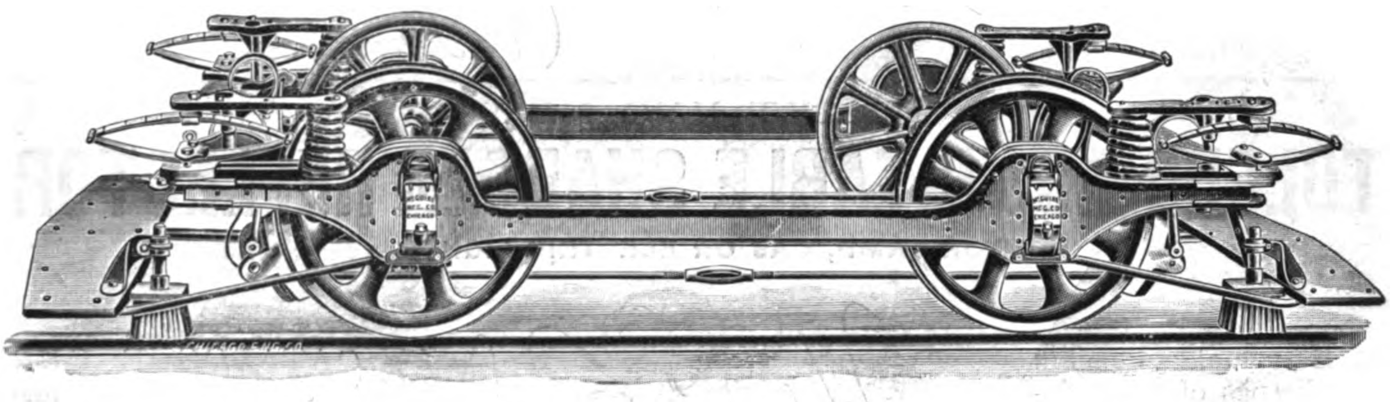

M'GUIRE'S "COLUMBIAN" ELECTRIC TRUCK

Frame is cushioned on Journal Boxes on Eight Spiral Springs. Reduces hammering on rail joints, prolongs life of motors and car bodies, prevents pounding when crossing railroad tracks, and by means of two sets of springs prevents Oscillation and makes

M'GUIRE'S NEW "COLUMBIAN"

the easiest riding Truck in the market

Four hundred and seventy sold since January 1st, 1893, to Detroit, Toledo, Rochester, Milwaukee, Chicago, Niagara Falls, Hamilton, Racine, Baltimore, Hot Springs, Peoria, Evanston. Huntington, Springfield, Mo., Springfield, O., Bay City, Mich.

The **M'GUIRE STEEL FRAME TRUCKS** never become obsolete, while we have taken in exchange for our **"COLUMBIAN"** other makes of trucks less than three years old, allowing only the price of scrap for them. We have never sold a Truck that cannot be converted into a

"COLUMBIAN"

......AT A COST NOT EXCEEDING $35......

Siemens & Halske Electric Company

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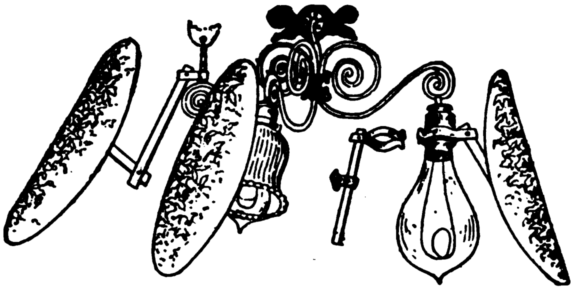
TOLEDO ADJUSTABLE SHADE AND REFLECTOR

FOR LAMP, GAS OR ELECTRIC LIGHTS

WE manufacture TIN SHADES of every description. WRITE FOR PRICES.



CATALOGUE OUR Shade. Electros furnished. Packed in ½ gross lots with assorted fixtures for gas or electric lights.

This is the only Shade that can be adjusted to shade the eyes, leaving the desk or room brilliantly lighted.

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WE MAKE A SPECIALTY OF

HOTEL AND HOUSE GOODS

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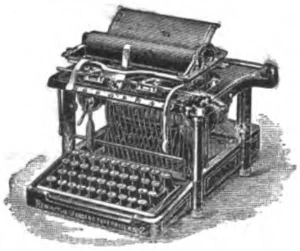
THE 1892

Model Remington Typewriter



PRESENTS many points of IMPROVEMENTS which will readily COMMEND THEMSELVES to all users.

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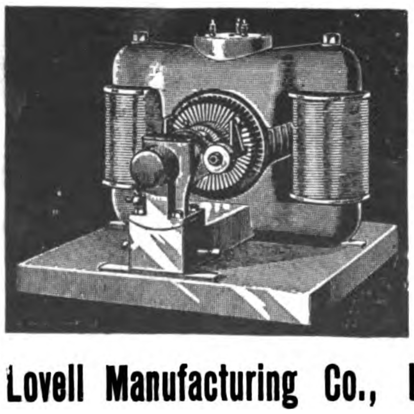
"Niagara" Motors and Dynamos



High Electrical Efficiency, Automatic Regulation, Composite Commutator Brushes . . . . .

No change of Commutator Brushes or Holders to reverse motion of Armature. The very best mechanical construction.

Correspondence Invited with Electrical Dealers & Engineers.

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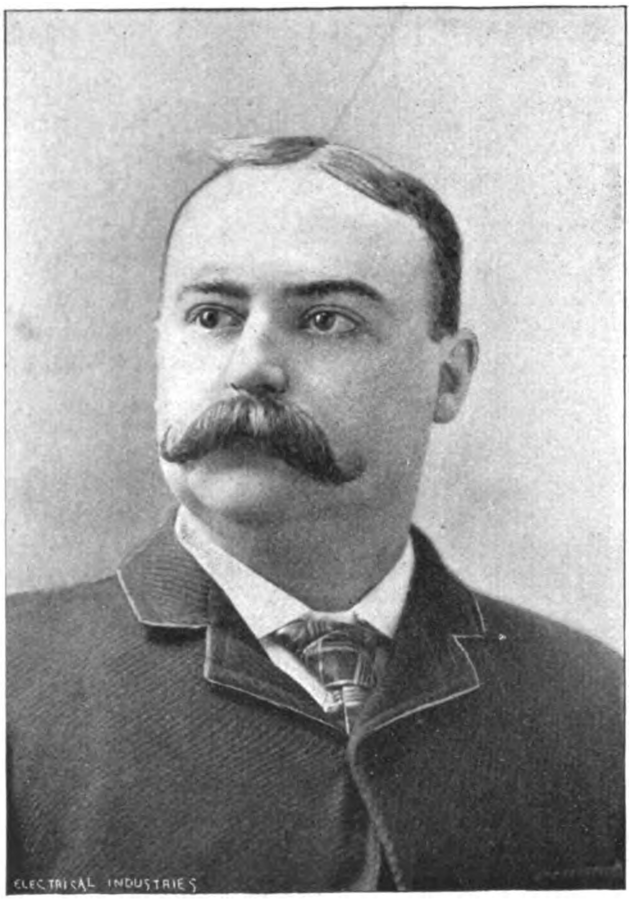
ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. April, 1893. NEW YORK. No. 4.

J. Allen Hornsby.

J. Allen Hornsby, assistant chief of the Department of Electricity of the World's Fair, was born at St. Louis, Mo., thirty-three years ago. His early education was received at the public and normal schools, it afterward being finished at a Military college. At an early age he began the study of the sciences allied to medicine and was graduated at St. Louis Medical College, a section of Washington University. After serving in various hospitals as assistant surgeon he was appointed by Jay Gould as superintendent of the department of medicine and surgery of the Missouri & Pacific Railroad and director of the Iron Mountain Hospital. Dr. Hornsby, however, gradually drifted away from medicine and surgery toward chemistry and the allied sciences and finally into the newspaper business as editorial writer for the Missouri *Republican* and the *Globe Democrat.* He was for a term clerk of the city of St Louis and was also coroner of St. Louis County, having thus had quite a taste of politics.



J. ALLEN HORNSBY.

In April 1890 Dr. Hornsby came to Chicago to help start the Chicago Evening *Post* and was an editorial writer on that paper until appointed by Professor J. P. Barrett as secretary of the Department of Electricity Since that time his name has become familiar to the most of our readers. The work of the department of which Prof. Barrett is chief has been very great and the office as secretary has been an onerous one, the details of which were thrown upon him. As an executive he has clearly shown his ability to carry out the policy of the department and handle the many vexatious problems connected therewith. A short time since by way of recognition of his work he was appointed assistant chief, which title he now bears. Dr. Hornsby is very popular with all the people he comes in contact with, his wide experience and natural good humor enabling him to meet all sorts of people in their different capacities. He represented his department with much distinction several months ago while abroad in its interests. He is genial and courteous in manner though naturally modest and unassuming. We are sure our readers will appreciate the excellent portrait which we are enabled to present to them.

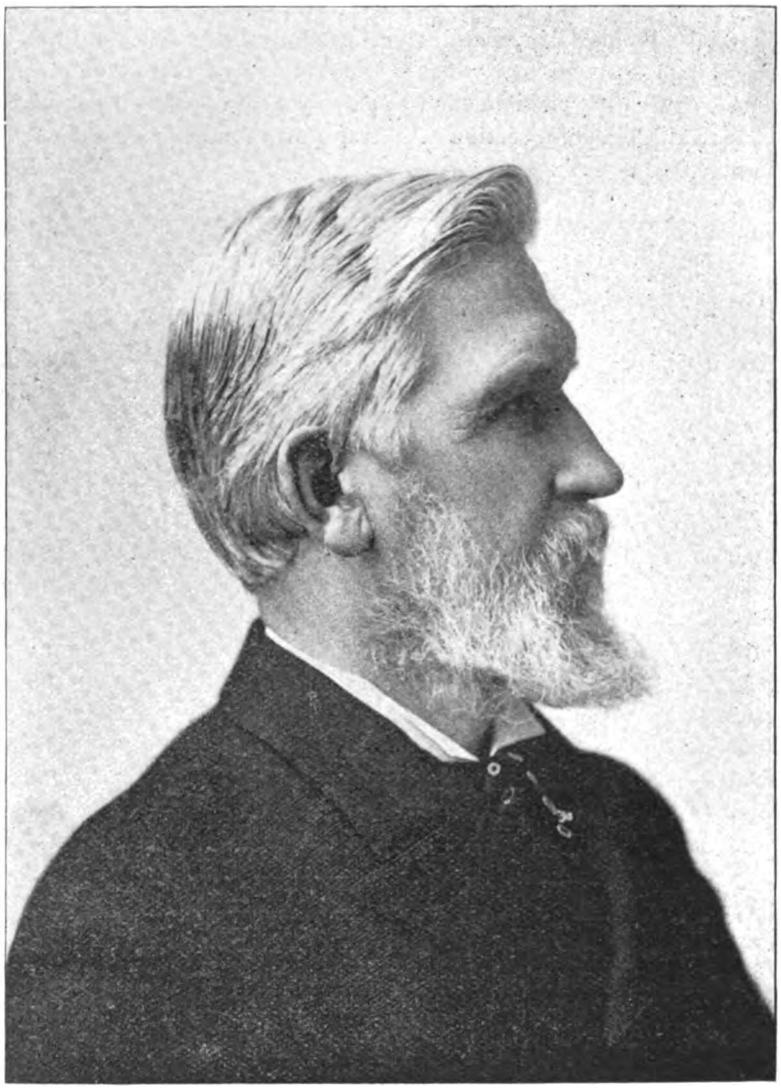
The Liverpool Electric Elevated Railway.

No recent event has attracted more attention in railway circles than the opening of the Liverpool Electric Elevated Railway, the first elevated railway in Europe. This road runs along the entire length of the Liverpool docks, a distance of a little more than six miles. It runs for the most part over the surface road which has been used for the transportation of passengers and freight. Omnibuses provided with broad tires allowing the omnibuses to run either on the railways or on the highway have been used for passenger traffic.

The idea of building an elevated road for passenger traffic in this district originated some thirty years ago in the mind of John Grantham, an engineer connected with the Mercy Docks, who proposed the road with six tracks for both passenger and freight traffic. The plan received considerable attention at the time and at different times since plans have been proposed looking toward the same end but none of them took definite shape until the winter of 1889 when the present road was undertaken. The roadway is built almost entirely of wrought iron. The spans are of the girder pattern, the normal length being about 50 feet. The power station containing four generators of the Elwell-Parker type having a capacity of 475 amperes of 500 volts each when running at 400 revolutions per minute, is placed near the middle of the line. The current is carried by a steel conductor mounted on porcelain supports midway between the rails. Contact is made by a sliding shoe hung from the under side of the truck. The car bodies are 45 feet long by 8 feet 6 inches broad, the seats placed transversely, with an aisle in the centre. The cars are divided into compartments for first and for second class passengers with entrances at the side. Each car is provided with a motor the train being made up of two cars. The cars are coupled so as to bring a motor at each end, only the forward motor being used at once. This road has been built at an expense of about $425,000 per mile including rolling stock and station. The contractors guarantee to run the road at an expense of about seven cents per train mile for two years.

The Telautograph.

The telautograph, the invention of Prof. Elisha Gray, was exhibited for the first time to the public of Chicago, on March 21st at 425 Home Insurance Building. Prof. Gray has spent the greater part of his life in electrical experiment and has produced many useful inventions in the different fields of electricity. Although formerly connected with several business houses dealing in electrical goods, for several years he has devoted his whole time to electrical experiment and the perfection of his most important invention. He has been the recipient of many marks of recognition and distinction both at home and abroad, and is a well known member of many of the scientific societies. Prof. Gray is now nearly 60 years of age but well preserved and looks forward to many years of activity.



PROF. ELISHA GRAY.

The first machine constructed by Prof. Gray was completed in 1887 which is shown in the accompanying cut. The sending and receiving apparatus was mounted on a table while in a box, raised above the table and supported on legs, was placed the machinery of the receiving apparatus. In this machine which was built on the variable resistance plan, no provision was made for raising or lowering the pen, nor for shifting the paper which was required to be done by the attendant. As the same defects were found in the use of this system, as are found in all variable resistance systems, it was abandoned and the step by step plan was adopted. On this latter plan a machine was completed in March, 1888. In this machine the sending and receiving apparatus were enclosed in separate cases mounted on a table; each case was supplied with a separate roll of paper. In this machine provision was made for raising and lowering the pen and also for shifting the paper.

The pen arms were worked by "gripping armatures," which were operated by impulses sent from the transmitter end. This machine was rather cumbersome and very complicated, the top of the table as shown in the cut, being filled with electrical mechanism.

In 1890 a third machine was constructed on which his first patent was granted in July, 1888. Very good results were obtained from this machine, but the machine was not considered suitable for commercial work and work was continued until the present machine was brought out.

The telautograph consists practically of two parts, the transmitter and the receiver connected by two wires, but both a transmitter and receiver are placed in each office The mechanism is entirely concealed in a case protected from dust. The only parts exposed in the transmitter are the pencils, similar to an ordinary feed lead pencil, with which the operator writes, to which two small silk cords are attached near the point, and the lever by means of which the paper is moved forward mechanically in the transmitter, and by means of an electrical connection that moves the paper in the receiver. These two silk cords attached to the pencil lead, one at right angles to the other, to drums supported on vertical shafts. Attached to the same shafts, but beneath the drums, are toothed wheels, the teeth of which are so arranged that when the drum is turned by the winding or unwinding of the cord a certain number of teeth corresponding to the length of cord wound or unwound will pass a certain point. The teeth on this wheel are so small that by moving the pencil in the direction of the cord one half of an inch 40 of these teeth will pass a given point. Each tooth in the wheel represents an electrical impulse. When writing both cords are being constantly moved and every minute movement of each cord is transmitted by a corresponding impulse to the receiver. There are two escapements in the receiver operated by polarized relays. Each electrical impulse causes the escapement wheel to feed forward or backward one step. There are also two drums the same size as the drums in the transmitter and mounted in the same manner to which the escape wheels are attached.

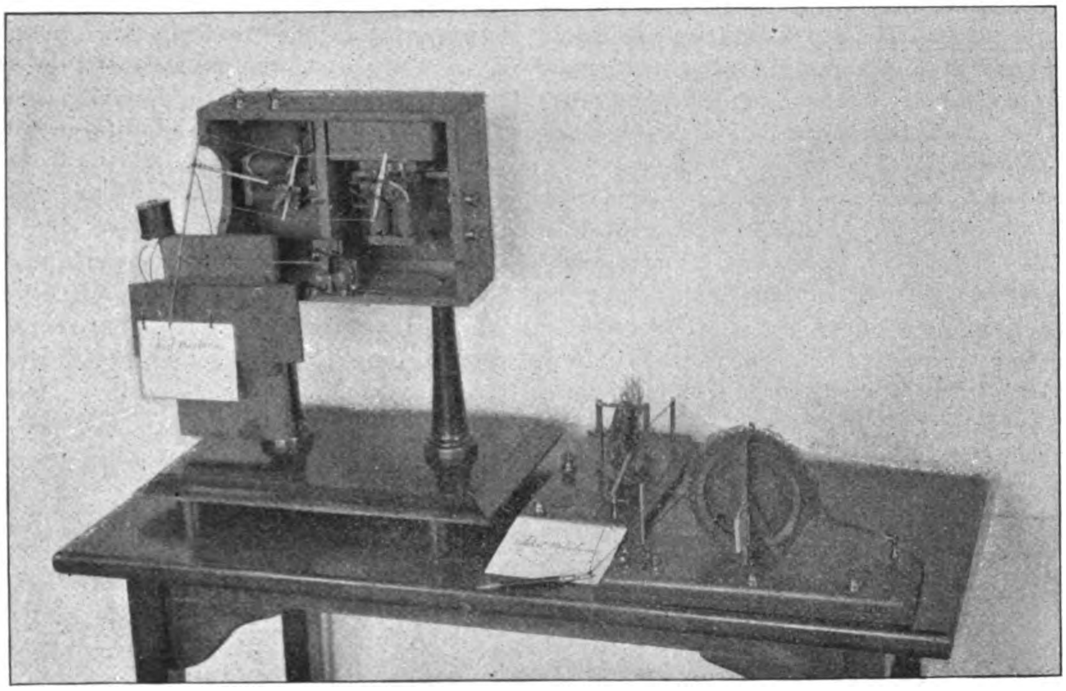
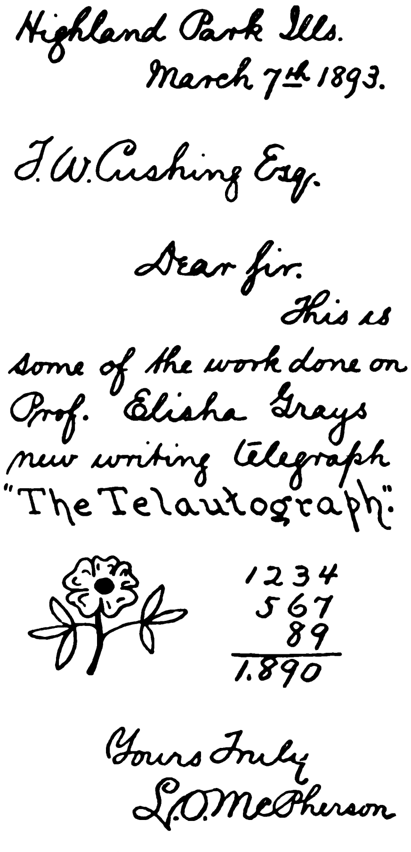


FIG. 5—THE FIRST TELAUTOGRAPH CONSTRUCTED IN 1887.



Highland Park Ills.
March 7th 1893.

J. W. Cushing Esq.

Dear Sir.
This is
some of the work done on
Prof. Elisha Grays
new writing telegraph
"The Telautograph".

1234
567
89
1.890

Yours Truly
L. O. McPherson

FIG. 3—FROM TRANSMITTER.

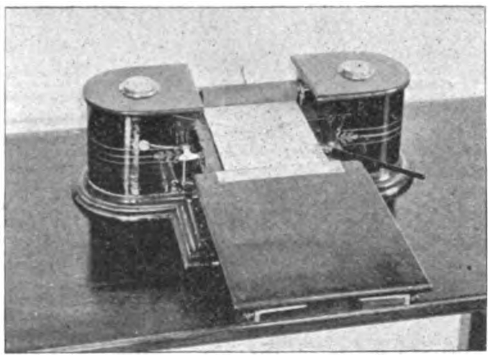


FIG. 1—THE PERFECTED TRANSMITTER.

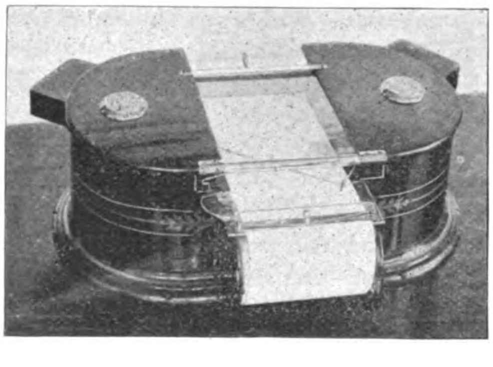


FIG. 2—THE PERFECTED RECEIVER.

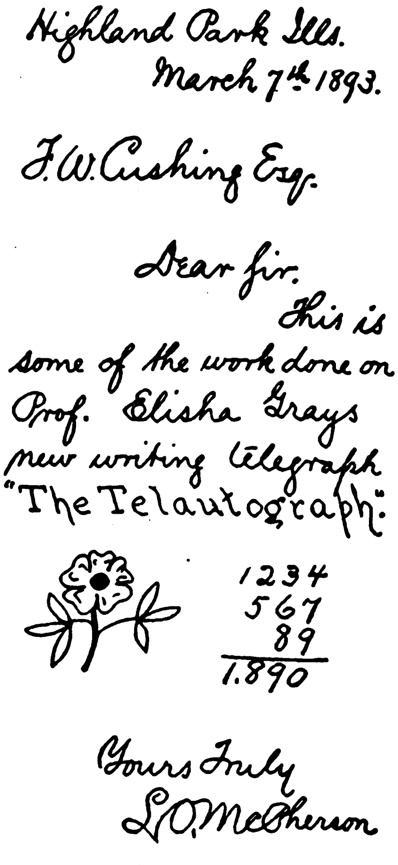


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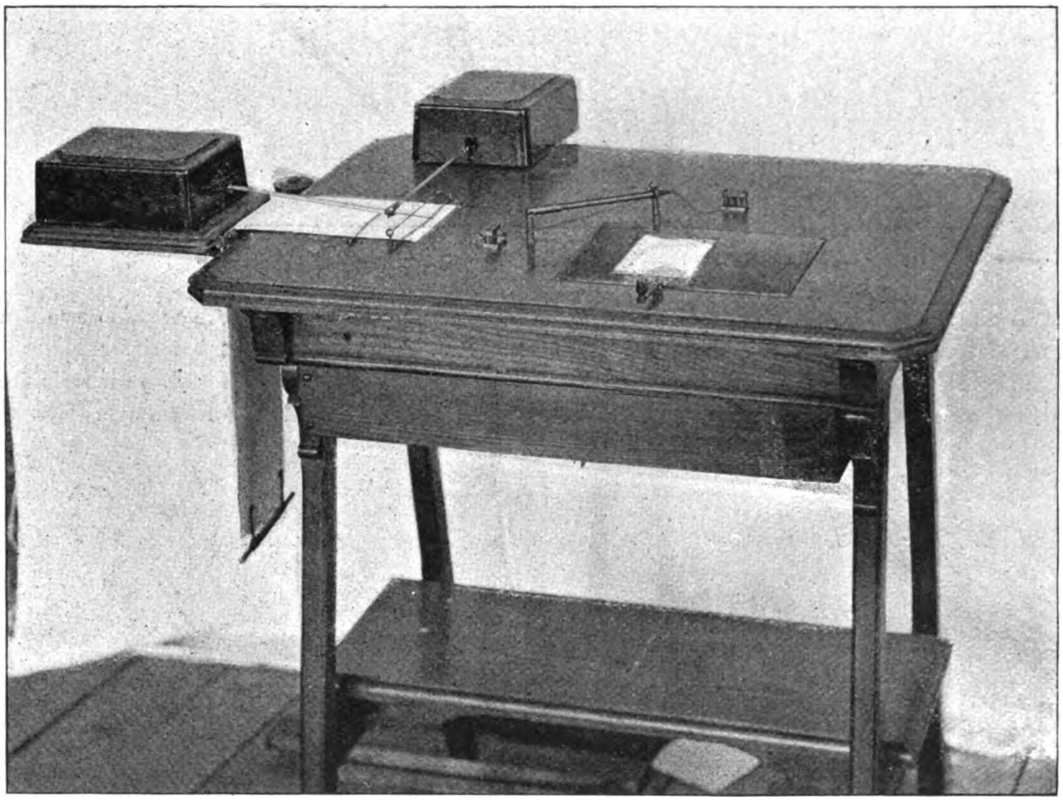
FIG. 4—FROM RECEIVER.

By means of cords aluminum arms are attached to the drums. These arms carry a pen at their end at which point they are connected by a hinged joint. Each movement of a cord in the transmitter is reproduced in the corresponding arm of the receiver and the movement of the pencil reduced into the movements of the two cords and transmitted by the electrical impulses to the arms of the receiver is reproduced in the movement of the pen by the combined movement of the two arms. The pen consists of a small glass tube in which the ink is held by capillary attraction, allowing the ink to flow only as the pen is drawn over the paper. The pen is fed from a reservoir through a small rubber tube in one of the arms. A good quality of paper is used, five inches wide placed in a roller under the arm rest of the transmitter and in a corresponding place on the receiver.

The telautograph is small and compact, requiring no more room than a typewriter. It is easily operated, in fact anyone who can write can operate it. The receiver requires no assistance but is controlled entirely by the operator at the transmitter, so that should the person to whom the message is sent, be out the message, or any number of messages, will be ready for him on his return. It is well adapted for an exchange system. One of the plans of the company being to put in exchanges similar to telephone exchanges. One of the most remarkable things about the telautograph is that each mannerism of the person at the transmitter can be detected by an acquaintance at the receiver for each minute movement of the pencil in the hands of the operator is reproduced by the pen in the receiver even before the pencil touches the paper, and when the operator commences to write, the hand writing is reproduced so exactly that a person at the receiver familiar with the hand writing can tell who is sending the message before he writes his name. The signature is exactly reproduced as shown in the message reproduced from photographs taken from the actual message written on the transmitter and the message as received at the other end of the line. The cuts also show something of what can be done in the way of sending drawings, diagrams, etc., which makes the telautograph especially of value in newspaper work. When a person has sent a message and received a reply he may take the copy of the message sent and the reply and file for future reference. Thus it is well adapted for the use of business men in this age when business communications are made in "black and white" as it were.

Although the chief credit for the production of the telautograph belongs to Prof. Gray, yet the services of L. O. McPherson, who has assisted Prof. Gray in all his telautograph experiments, deserve some recognition. Foster Richie who has been the professor's chief mechanical expert is now superintendent of the factory at Highland Park, and to him is due much of the credit for the mechanical excellency of the machine.

The telautographs are now manufactured by the Gray National Telautograph Company, who have erected a factory at Highland Park, Ill. The company has secured space at the World's Fair and promise a very fine and interesting exhibit.



FIF. 6—TELAUTOGRAPH CONSTRUCTED IN 1888.

Obituary.

Mr. Samuel Boardman, president of the Bishop Gutta Percha Company, died at his residence at Newark, N. J., March 14th. Mr. Boardman was born in Manchester, Eng., in 1816. He came to New York in 1832 and was soon afterward appointed surgeon of the United States arsenal at Chattahoochee, Fla. Later he studied law and at the time of his death was senior member of the well known law firm of Boardman & Boardman. One of his first clients was Mr. C. S. Bishop, the proprietor of the Bishop Gutta Percha Works, whose attorney he was until the death of Mr. Bishop and afterward for Mrs. Bishop in whose name the business was conducted until the time of her death which occurred in 1885. Mr. Boardman in 1885 organized the present Bishop Gutta Percha Company of which he remained president up to the time of his death. He was for several years a member of the Manhattan Club and of the Bar Association, of New York.

Great Western Manufacturing Company.

Probably no company of recent organization has secured a more prominent place in the commercial field of electric manufacturers than the Great Western Manufacturing Company. This company is the result of the consolidation of the Great Western Supply company, the Chicago Insulated Wire company, the Bain Electric Manufacturing company of Chicago, the Phoenix Manufacturing company of Duluth and the Western Electrical Supply company of St. Louis. The organization was completed January 13, 1893, with a paid-in capital of $1,500,000, of which $1,300,000 is in common stock and $200,000 preferred.

All the assets of the several companies, cash, stock on hand, raw material, machinery, good will, bills, accounts receivable, office fixtures, patents—in short, assets of whatever description—have been transferred to the new company. The value of these assets has been passed upon by a committee appointed by those constituting the new company, and it was, at a conservative estimate, taken at $1,300,000. The $200,000 preferred stock has been subscribed for at par, $100,000 in cash having been raised by Duluth capitalists and the remaining $100,000 by eastern men. The factories of the different companies have been consolidated at Duluth with the exception of the former factory of the Chicago Insulated Wire Company, which still remains at Sycamore, Ill.

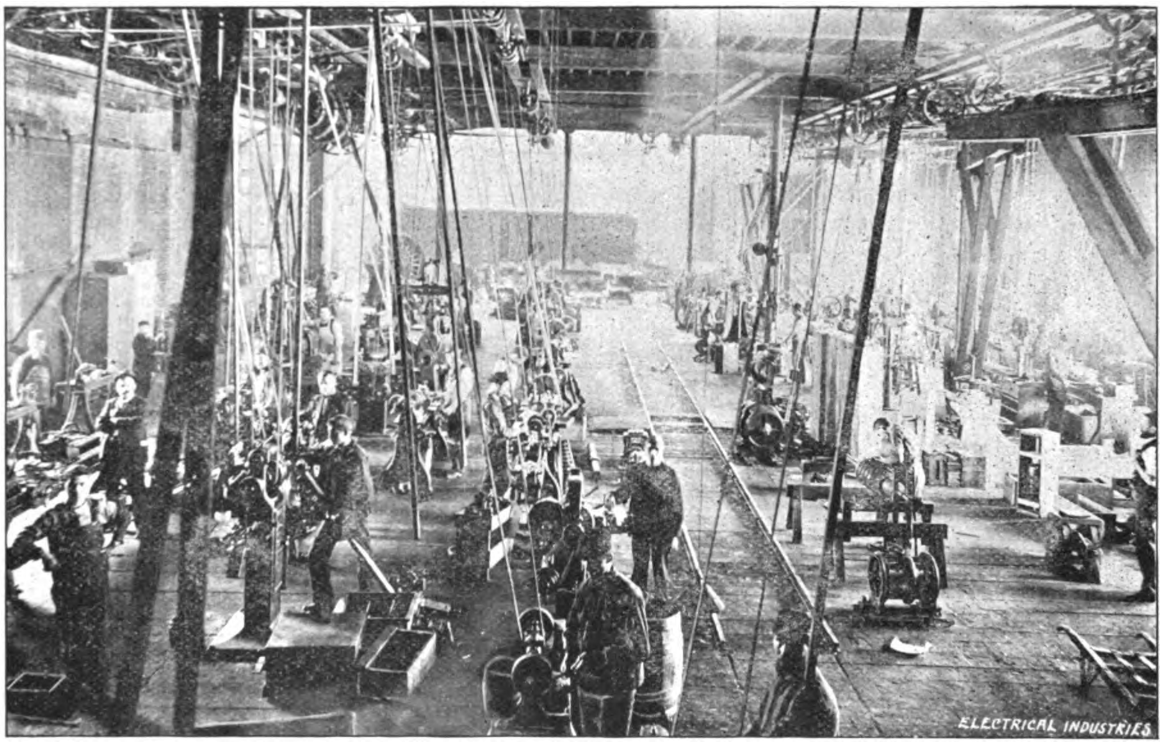


FIG. 2—MACHINE SHOP, GREAT WESTERN MANUFACTURING CO.

The accompanying engravings will give the reader a good general idea of the Duluth plant. In the big factory power is supplied by three engines, one Corliss with 14 by 30 inch cylinder, and two automatics, with cylinders respectively 6 by 10 and 10 by 20. Steam is furnished by two tubular boilers 16 feet long and 5 feet in diameter, and the plant is rendered complete by a steam pump and feed water heater. There is also a pumping station, equipped with a 20-horse power boiler, Knowles pump and Korting injector, water being taken from Bay St. Louis. The dynamo equipment consists of five machines, a Thomson-Houston 250-light incandescent machine and a Ball arc dynamo of 25-lights capacity for lighting the building, a Sperry 50-lighter and a Thomson-Houston machine of 15 lights capacity for testing the arc lamps, and a small Eddy dynamo used for furnishing current in the plating room.

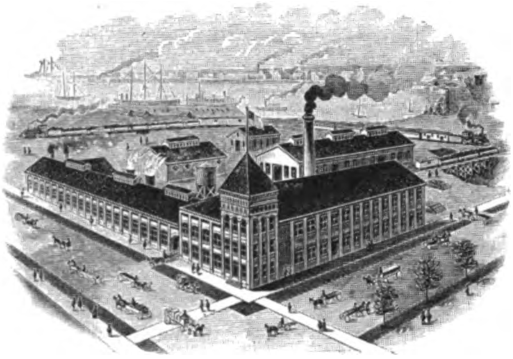


FIG. 1—PERSPECTIVE VIEW OF DULUTH FACTORY.

The factory is completely equipped for machine work, the plant including a 12-ton Walker travelling crane, three 15-ton cranes in the foundry, and three 10-ton cranes in the machine shop, 1,800 feet of shafting, about 30 lathes, as well as slotting machines, planers, etc. All the buildings are connected by tunnels. The two-storied wing contains the power plant, machine shop, fixture rooms and plating and polishing department, while the foundry and blacksmith shop are in the eastern wing. The central portion is devoted to offices, show rooms, stock room and draughting department.

Almost all kinds of electrical apparatus and supplies are manufactured by this company. Electrical fixtures and accessories in endless variety, dynamos and motors together with electric mining machinery are manufactured by this company. It also manufactures several kinds of annunciators and braided insulated wire. All the various departments are supplied with modern machinery and are extensively equipped. The factory at Duluth is especially well located at Bay St. Louis at the head of navigation on Lake Superior in the vicinity of the great iron and copper mines in the northwest which products are used to such a large extent in the manufacture of electrical supplies and machinery. It is also situated near the source of its fuel supply, thus enabling the company to secure it at a low figure. Its shipping facilities by water together with the railroads, to which the factory is connected by side tracks, makes its location excellent for the transportation of its goods.

The business of the company is under the management of E. R. Gilman who is well known as the former president of the Northwest Thomson-Houston Electric Company. Mr. Gilman is a man of large experience in the electrical field which he entered many years ago. This together with his business ability which he has shown in his connection with the different companies with which he has been connected shows that the company has been wise in the selection of its manager. Mr. Casey, the president of the company, is a man well known throughout the northwest as a man of large means and as a conservative business man and banker.

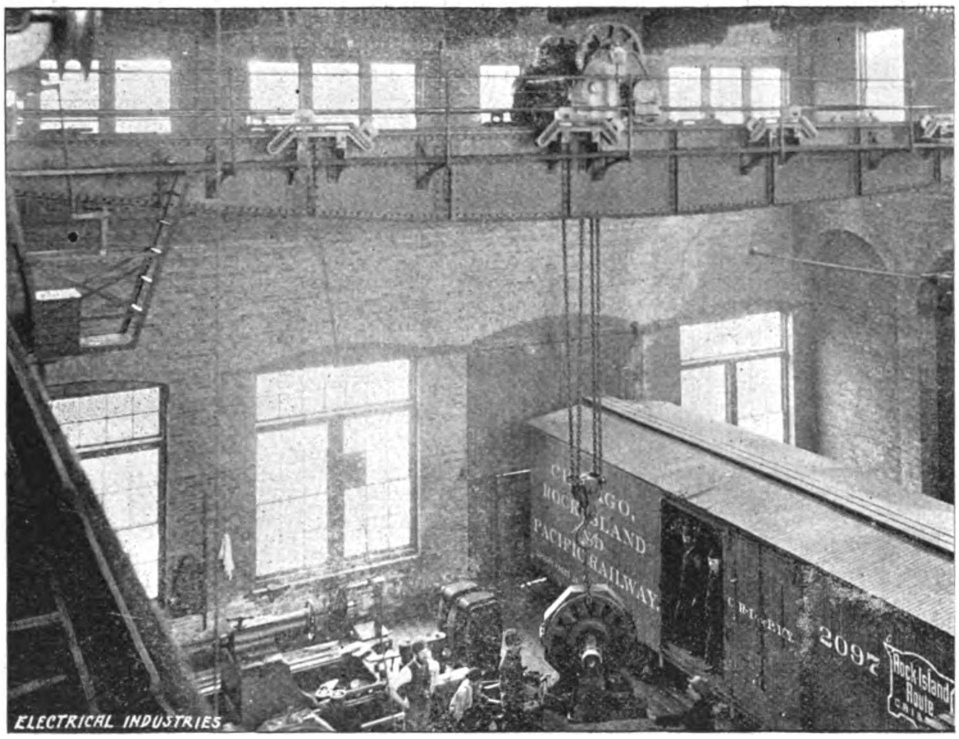


FIG. 3—TRAVELING CRANE, GREAT WESTERN MANUFCTURING CO.

The first vice-president and managing director is R. S. Munger, president of the Imperial Mills company, Duluth, Minn.; second vice-president, Stephen J. Young, President Union National Bank, Brunswick, Me.; third vice-president and assistant treasurer, O. H. Simonds, general manager Duluth Terminal Railway company, Duluth; secretary and treasurer, H. A. Odell, attorney, Chicago.

Among other prominent stockholders are ex-Governor Merriam, St. Paul, Minn.; H. K. Gilman, Chicago; John L. Dodge, Great Barrington, Mass.; Col. C. H. Graves, Duluth; Judge O. P. Stearns, Duluth; J. D. and R. C. Ray, Duluth; Duncan, Brewer & Co., Duluth; P. McDonnell, Duluth; Joseph Sellwood, Duluth; C. E. Dickerman, St. Paul; J. B. Sutphin, Duluth; E. H. Hall, Duluth; E. G. Chapman, Duluth; Judge J. D. Ensign, Duluth; Myers Bros., Duluth; John Crerar, Chicago; A. Harrington, Minneapolis; H. W. Wheeler, Duluth; Gilliam & Pemberton, Richmond, Va.; Lieut. S. Y. Seyburn, U. S. A., Detroit; Duluth Land & Loan Company; Gen. Robert Mac-Feeley, Washington, D. C.; Capt. D. Pratt Mannix, U. S. N., Washington, D. C.; R. M. Newport, P. T. Barr, St. Paul, Min.; Eugene Scharff, New York; Phœnix Glass Company, Pittsburg; J. H. Gregory, Chicago; R. Park von Wedelstaedt, St. Louis; Edward Carroll, Leavenworth, Kan.; Col. J. H. Gilman, U. S. A., Chicago.

The manager of the Chicago office is H. K. Gilman, for a long time the active head of the Great Western Electric Supply Company. Mr. Gilman is well known throughout the west, and brings to the new company a large experience and ability which will add much to the success of the enterprise. J. C. Rafferty, who is well and favorably known in the trade, is assistant general manager, and has full charge of the sales department. J. L. Parmele will remain in charge of fixtures as heretofore. R. V. Scudder is the manager of the St. Louis house, and he has already built up a good business in the southwest. Foree Bain will have charge of the electrical work at the factory. Mr. Bain, who is one of the best equipped electrical engineers in the west, has had a large experience with electrical mining machinery and has devoted special attention to this class of apparatus. For the mining of coal, Mr. Bain has devised a complete set of machinery, and for quarrying stone he will soon place upon the market a reciprocating rock drill, and the company expects soon to introduce the Bain system of alternating electric light machinery.

The insulated wire factory of the company, at Sycamore, Ill., it may be mentioned, is a two-story brick building 216 feet long and 42 feet wide. Two large frame warehouses are used in connection with it. Nearly all the operations of insulating wire are performed by machinery. 160 braiders and 142 other machiners are used in this connection at this factory. The capacity of this factory is from 25,000 to 30,000 pounds of wire a week. All the different compounds, paints and waxes used in the manufacture of the wire, are prepared on the premises. The power is furnished by an Allis 40-horse power engine, which also operates a 200-light Edison dynamo, furnishing light for the factory.

Plans are also completed for a wire mill to be located at the Duluth works for drawing wire from the ingot. It is anticipated that this mill will be in working order some time in the fall, and by that time the Sycamore Insulated Wire Factory will also be removed to Duluth. The natural advantages which Duluth offers in the delivery of ingot copper from the mines near by will enable the company to turn out its product and deliver it in the West somewhat cheaper than the eastern manufacturers can do.

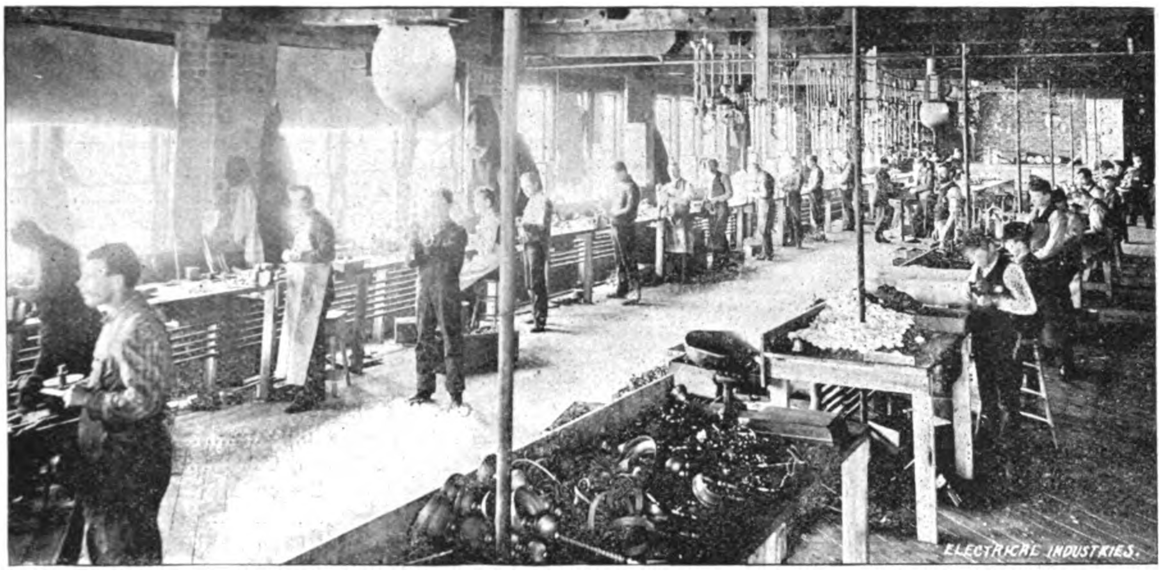


FIG. 4—FIXTURE DEPARTMENT, GREAT WESTERN MANUFACTURING CO.

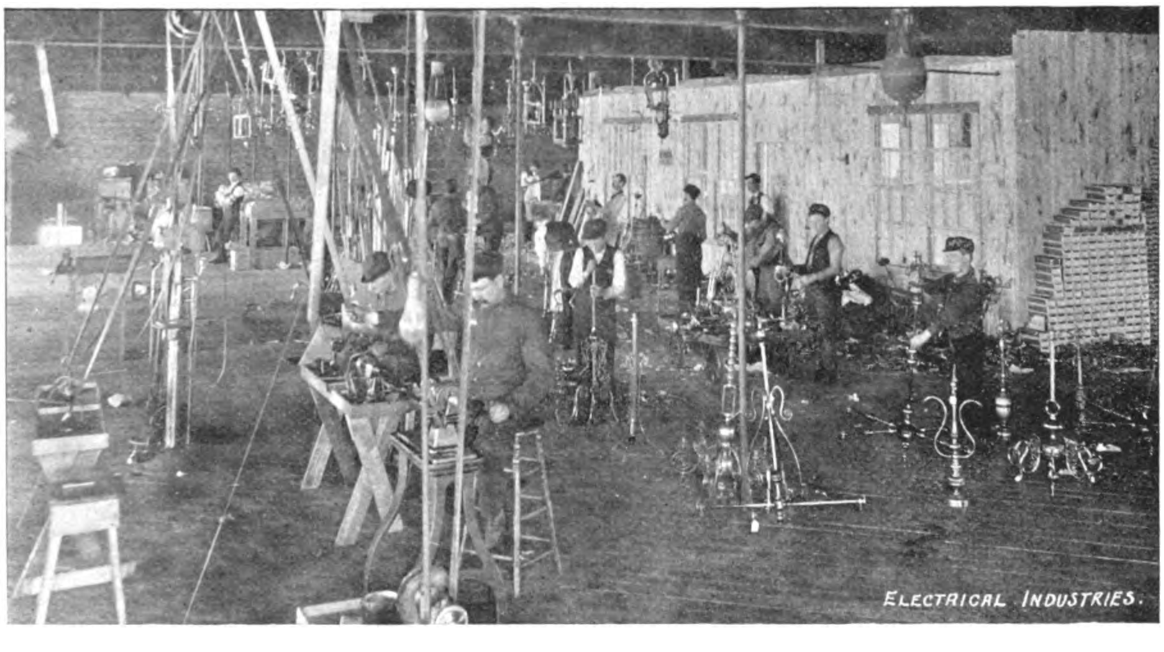


FIG. 5—ASSEMBLING ROOM, GREAT WESTERN MANUFACTURING CO.

A complete line of electrical supplies and apparatus will be carried in stock at both the Chicago and St. Louis offices, where the business will be carried on. The company is prepared to contract for the complete installation of central station plants for lighting and power, the material for which will be supplied from its own factories.

Certainly, with its strong backing and two well equipped factories, the new company starts out in the electrical business with every prospect of success.

The "Vulcanizing" Process for Preserving and Strengthening Poles, Cross Arms, Ties, Etc.*

BY HARRY C. MYERS, PH. D.,

Hundreds of processes for perserving wood have been patented, and all of them may be divided into two classes: I. Those in which wood is impregnated with a preservative material by immersion. II. Those in which a preservation agent is forced into the pores of the wood. Such chemicals as copper sulphate, zinc chloride, dead oil, etc., have been applied, but experience and results have failed to prove them all that is to be desired in an economic and effective means of wood preserving. The poisonous nature of such chemicals make the application and use of them very objectionable.

As vulcanizing changes the sap from the liquid to the solid or semi-solid state, does not char or make the wood brittle, saturates and seals up the pores of timber with solid matter instead of liquid soluble matter which nature provides, considerable of strength and durability are added by vulcanizing, the wood being rendered more cohesive, harder and denser. The spike holding quality is naturally much increased, and even after ten years' service, railroad spikes seem to be as firmly imbedded as when just driven.

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* Abstract of paper read before the National Electric Light Association, St. Louis, Mo.

Electrical Exhibitros at the World's Fair.

The allotment of the space in the Electricity building has been a long and difficult task which Prof. Barrett and his assistants have at last completed and the following list, which is the first complete and accurate one published, with the space assigned, represents with a few exceptions the arrangement of the Electricity building during the World's Fair. By studying the list in connection with the diagram on the insert exhibitors may get an idea of the location of their exhibit and also of the exhibitors near them as well as a general idea of the exhibitors. The floor space of the building is divided into sections which are designated by the capital letters and each section is subdivided into spaces designated by numerals. Where no space is designated in the list the exhibitor exhibits with some one else.

	SEC.	SPACE
Ansonia Elec.Co., Michigan Ave., Chicago	Z	1
American Bell Telephone Co., Boston, Mass	G	1
Anthony Elec. Inst. Co., 9 Met. Block, Chicago	M	1, 2
Arnold Mfg. Co., Chester, Pa	E	4
American Graphaphone Co. Washington, D. C	S	14
American Battery Co., La Salle St., Chicago	U	14
American Engine Co., Bound Brook, N. J	...	...
Acme Filter Co., St. Louis, Mo	...	...
Brooks, R. T., 82 John St., New York	T	22
Brush Elec. Co., Cleveland, Ohio	L	6, 7
Billings & Spencer Co., Hartford, Conn	Y	24
Bemis Car Box Co., Springfield, Mass	...	...
Briggs Orlands, 227 S. Clinton St., Chicago	...	...
Burton Elec. Co., Richmond, Va	...	...
Belknap Motor Co., Portland, Maine	E	2
Bottome Turner D, Indianapolis, Ind	T	13 r
Brady, T. H., New Britain, Conn	Y	45
Brixey, W. R., 203 Broadway, New York	T	2
Bates Mfg. Co., New York	Y	43
Benham, A. D., 200 S. Clinton St., Chicago	S	16
"C. & C." Elec. Motor Co., New York	A	2
Cutter, Geo., 333 "The Rookery", Chicago	T	3
Casper, Louis, Cheyenue, Wyo	S	21 a
Consolidated Elec. Storage Co., Philadelphia, Pa	T	23
Crocker-Wheeler Elec. Co., New York	L	1
Commercial Cable Co., 1 Broadway, New York	Y	2
Chicago Elec. Wire Co., of Wilmington Wilm'gton, Del.	T	15
Cleveland Flect. Mfg. Co., Cleveland, Ohio	P	7
Commercial Elec. Co., Indianapolis, Ind	F	4
Central Elec. Co., Franklin St., Chicago	U	8
Copenhagen Automatic Fire Alarm Co., Chicago	Y	14
Cooper Elec. Heater Co., "The Rookery", Chicago	...	...
Chicago Belting Co., Chicago	F	5
Can Engine Co., J. L., New Britain, Conn	...	...
Campbell Elec. Supply Co., Boston, Mass	...	...
Crowell, Gilmer, Brooklyn, N. Y	...	...
Crane Elevator Co., Chicago	...	...
Curtis Elec. Mfg. Co., Jersey City, N. J	F	7
Carpenter Enamel Rheostat Co., Bridgeport, Conn	...	...
Devey, Matthew H., 353 Parker St., Chester, Pa	S	6
DuLaney Clock Co., 79 Dearborn St., Chicago	R	5
Detroit Elec. Works, Detroit, Mich	H	1
DeLand, Fred, "The Rookery", Chicago	Y	28
Diamond Elec. Mfg. Co., Peoria, Ill	...	...
Degenhardt F., 542 "The Rookery", Chicago	L	5
De La Frere, M., Minneapolis, Minn	T	10
Electrical World, Times Bldg., New York	Y	31
Elgin Acoustic Telephone Co., Elgin Ill	Y	21
Eureka Tempered Copper Co., North East, Pa	U	14
ELECTRICAL INDUSTRIES, Monadnock Bldg., Chicago	Y	27
Electrical Forging Co., Boston, Mass	D	2
Electrical Engineer, 150 Broadway, New York	Y	32
Electrical Review, 13 Park Row, New York	Y	31
Electricity Newspaper Co., 6 Pk. Place, New York	Y	34
Electric Selector & Signal Co., 45 B'dway, N. Y	U	19
Electric Heat Alarm Co., Boston, Mass	Y	15
Eddy Elec. Mfg. Co., Windsor, Conn	B	3
Elec. Adver. & Display Mfg. Co., Philadelphia, Pa	W	1
Electrical Machine Co., Chicago	Y	36
Electrical Appliance Co., Chicago	U	16
Excelsior Elec. Co., 42 Broad St., New York	B	5
Egan, Chas. E., Englewood, Chicago, Ill	Y	37
Empire China Works, Brooklyn, N. Y	S	19
Electro Med. Battery Co., Kalamazoo, Mich,	Y	18a
Edison, Thomas A., Orange, N. J	J	1
Edgerton, E. M., 301 63rd St., Chicago	Y	18b
Elwell-Parker Elec. Const. Co., of America, Chicago	E	3
Elec. Piano & Motor Co., Newark, N. J	S	17
Electrical Conduit Co., 32 Nassau St., New York	P	1
Elektron Mfg. Co., Springfield, Mass	P	4
Elec. Gas Co., Boston, Mass	T	13 b
Elliott Elec. Co., Cleveland, O	P	9
Elec. Specialty Co., Denver, Colo	S	21 b
Eco Magneto Clock Co., Boston, Mass	...	...
Electric Co., Canton, O	T	8b
Ft. Wayne Elec. Co., Ft. Wayne, Ind	M	3
Ford-Washburn Storelectro Co., Cleveland, O	U	15
Franklin Elec. Appliance Co., Boston, Mass	S	1
Falls Rivet & Machine Co., New York	...	...
Fein, C. & E., Stottgart, Germany	...	...
Guillaume, Alfred, 215 Dearborn St., Chicago	T	4
Gray, Elisha, Highland Park, Ill	W	5
Greeley, E. S. & Co., 5 & 7 Dey St., New York	F	8
General Elec. Co	B 4, C 1, H 2, J 1, M 4, O3	
Gamewell Fire Alarm Tele. Co., Ashland Blk., Chicago	V	1
General Fixture Co., 292 Ave. B., New York	...	...
Graton & Knight Mfg. Co., Worcester, Mass	...	...
Gault & Co., N. C., Winona, Minn	Y	46
Gamewell Fire Alarm Tele. Co.; Chicago	...	...
Griffin Wheel & Foundry Co., Chicago	...	...
Hanson & Van Winkle Co.. Chicago	L	4
Heisler Elec. Co., Drexel Bldg., Philadelphia, Pa	O	4
Holmes, Nathaniel L., Ann Arbor, Mich	W	1
Healey & Millets, Chicago	...	...
Hope Elec. Appliance Co., Providence, R. I	Y	11
Hirleman, Chas. J., New York	S	3
Hall, Chas. Fred., New Grand Hotel, Chicago	U	17
Houlehan, Jas., 489 N. Clark St., Chicago	Y	9
Hurd, Jno. F., Chicago	S	5a
India Rubber Comb Co., 9 Mercer St., New York	S	11
Illinois Alloy Co., 41 Portld. Blk., Chicago	Y	19
Ingersoll-Sergeant Drill Co., 10 Pk. Place, New York	...	...
International Automatic Lt. & Pr. Co., Chicago	U	3
Jenney Elec. Motor Co., Indianapolis, Ind	L	2
Johns Mfg. Co., H. W., New York	U	21
Jewell Belting Co., Hartford, Conn	F	6
Jaeger, Chas. L., Maywood, N. J	Y	10
Jackson & Sharp Co., Wilmington, Del	...	...
K. A. P. Elec. Novelty Co., La Crosse, Wis	V	2
Koch, G. F., 2406 W. Chest. St., Louisville, Ky	S	5b
Knight Coin Automatic Boot Blacking Co	T	16 b
Leclanche Battery Co., New York	V	7
Lawton, Harry A., & Kennon Mott, Brunswick, Ga	U	4 a
Lincoln Elec. Co., Cleveland, O	P	8
Lee, Chas. E., 9 Lakeside Bldg., Chicago	S	20
Lawrence Machine Co., Lawrence, Mass	...	...
Lake Erie Engineering Works, Buffalo, N. Y	...	...
Lidgerwood Mfg. Co., 96 Liberty St., New York	...	...
Munson Lightning Conductor Co., Indianapolis, Ind	U	12
Marcus, William N., Philadelphia, Pa	Y	12
Mather Elec. Co., 9 Met. Blk., Chicago	M	1,2
Mather, A. C., 169 Adams St., Chicago	E	5
Munson Belting Co., 36 S. Canal St., Chicago	D	4
Merrill Bros., 465 Kent Ave., Brooklyn, N. Y	...	...

EC.	SPACE.
A	4, 5
V	3
T	6
Y	33
R	6
B 1, 2 F 1	
V	8
P	10
T	17
Y	45
Y	13 b
U	26
S	13
U	27
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A	6
F	2
Y	38
W	4
P	6
O	5
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D 1, E 1	
W	7
O	6
Y	39
Y	8

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Arnold Mfg.
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Acme Filter
Brooks, R. T
Brush Elec.
Billings & Sp
Bemis Car B
Briggs Orlan
Burton Elec.
Belknap Mot
Bottome Tur
Brady, T. H.
Brixey, W.
Bates Mfg. C
Benham, A.
"C. & C." E
Cutter, Geo.,
Casper, Loui
Consolidated
Crocker-Whe
Commercial
Chicago Elec
Cleveland F
Commercial
Central Elec.
Copenhagen
Cooper Elec.
Chicago Belt
Can Engine
Campbell Ele
Crowell, Giln
Crane Elevat
Curtis Elec.
Carpenter En
Devey, Matt
DuLaney Cl
Detroit Elec.
DeLand, Fre
Diamond Ele
Degenhardt
De La Frere,

	SEC.	SPACE.
Meywurtz, E. B., 104 E. 23rd St., New York	...	...
Meeker, Dr. G., 244 Mulberry St., Newark, N. J	S	15
Murphy, T. J., 136 Liberty St., New York	...	...
McCaskey Alfred S., & J. A. Ellis	V	11 b
McIntosh Battery & Optical Co., Chicago	W	3
McNeil Tinder Elec. Co , Winchester, Ky	U	20 a
McIntosh, Seymour & Co., Auburn, N. Y	...	...
New York Insulated Wire Co., New York	T	11
National Carbon Co., Cleveland, O	Y	20
Newman Clock Mfg. Co., 279 Dearborn St., Chicago	Y	40
Norwich Insulated Wire Co., 44 Bd. St., New York	T	18
New England Butt Co., Providence, R. I	T	12
North American Elec. Co., New York	S	12
Non-Magnetic Watch Co., 117 B'dway. New York	S	23
National Engraving Machine Co., Chicago	S	8
New York Air Brake Co., 115 B'dway, New York	...	...
National Conduit Mfg. Co., Times Bldg., New York	...	...
National Automatic Fire Alarm Co., New York	A	3
North American Phonograph Co., Masonic T'mle, Chic.	S	'2
Oehring, A. J., 124 Fremont St., Chicago	...	...
Okonite Co., New York	...	...
Owens, Dr. A., Chicago	U	1
Paiste, H. T., 10 S. 18th St., Philadelphia, Pa	S	22
Page Belting Co., La Salle & Lake Sts., Chicago	D	5
Pumpelly, Jas. K., 205 S. Canal St., Chicago	T	13
Pennock Battery, Elec. Lt. & Impt. Co., Chicago	T	8a
Phoenix Glass Co., Pittsburgh, Pa	I	1
Phelps, A. H., M. D., Glens Falls, N. Y	U	20 b
Powell, Wm., Co., Cincinnati, O	U	18
Police Telephone & Signal Co., Chicago	...	...
Pratt Electro Med. Supply Co., Chicago	U	11 a
Pelton Water Wheel Co., San Francisco, Cal	...	...
Platt, O. S., Bridgeport, Conn	...	...
Pendleton Glass Tube & Pipe Works, Pendleton, Ind	U	4 a
Pass & Seymour, Syracuse, N. Y	...	...
Queen & Co., Jas. W., 1010 Chest. St., Philadelphia, Pa.	E	7
Railway Equipment Co., Chicago	R	7, 8
Roessler & Hasslacher Chem. Co., New York	S	9
Rauscher, John, St. Paul, Minn	Y	16
Ringler, F. A., Co., New York	R	1 a
Robinson Elec. Truck & Supply Co., Boston	...	...
Russell & Co., Massillon, O	...	...
Rowell-Potter Safety Stop Co., Boston, Mass	...	...
Reliance Gauge Co., Cleveland, O	T	16 a
Rockford Elec. Mfg. Co., Rockford, Ill	...	...
Rockford Elec. Mfg. Co., Rockford, Ill	...	...
Standard Underground Cable Co., Chicago	L	5
Sponholz, Carl L., Lowell, Mass	Y	13 a
Standard Paint Co., "The Rookery", Chicago	T	20
Striemer, A., South Superior, Wis	Y	13 c
Sigler, Jas. O., Paterson, N. J	Y	26
Strowger Automatic Telephone Exchange, Chicago	T	7
Sample, H. C., 145 Ontario St., Chicago	S	10
Stanley Elec. Mfg. Co., Pittsfield, Mass	Z	1
Schieren, Chas. A., & Co., Chicago	D	8
Standard Elec. Signal Co., Rochester, N. Y	Y	17
Stephenson, John, & Co., Ltd., New York	...	...
Standard Elec. Co., 625 Home Ins. Bldg., Chicago	P	2,O1
Steam Stone Cutter Co., Rutland, Vt	...	...
Sosman & Landis, 236 So. Clinton St., Chicago	...	...
Star Iron Tower Co., Ft. Wayne, Ind	...	...
Stevens, N. P., Concord, N. H	T	21 a
Street Railway Journal, New York	Y	30
Swan Lamp Co., Cleveland, O	...	...
Sperry Elec. Ry., New York	...	...
Todd, John T., 340-342 Dearborn St., Chicago	S	4
Thomson Elec. Welding Co., Boston, Mass	O	2
Thomson-Houston Elec. Co., Lynn, Mass	...	...
Thermo Elec. Heat Regulating Co., Easton, Pa	R	3
Taylor Elec. Truck Co., Troy, N. Y	...	...
Taylor, Goodhue & Ames, Monadnock Bldg., Chicago	A	7
Union Elec. Co., 45 Broadway, New York	F	3
Union Elec. Co., do	...	...
Utica Elec. Mfg. & Supply Co., Utica, N. Y	R	4
Union Elec. Works, 207 So. Canal St., Chicago	R	1, B 2
Vetter, J. C., & Co., Meyrowitz Bldg., New York	W	2
Vail, W. A., New York	...	...
Van Nuis, C. S., 136 Liberty St., New York	...	...
Western Elec. Co., 227 Clinton St., Chicago	A	4, 5
Washburn & Moen Mfg. Co., Worcester, Mass	V	3
Waterhouse Bros., 302 Ayslum St., Hartford, Conn	T	6
Western Electrician, 6 Lakeside Bldg., Chicago	Y	33
Weston Elec. Inst. Co., Newark, N. J	R	6
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa	B 1, 2 F 1	
Western Union Tele. Co., Chicago	V	8
Wing, L. J., & Co., 126 Libty. St,, New York	P	10
Waddell-Entz Co., Bridgeport, Conn	T	17
Webb, G. F., Dr., Cleveland, O	Y	45
Wullweber, O. L., & Co., 49 Fklin. St., Chicago	Y	13 b
Waite & Bartlett Mfg. Co., New York	U	26
Willoughby, Chas., San Francisco, Cal	S	13
White, S. S., Dental Mfg. Co., Philadelphia, Pa	U	27
White, Jas., Glasgow, Scotland	...	...
Webster Mfg. Co., 195 Canal St., Chicago	...	...
Wharton, Wm., Jr., & Co., (Ins) Philadelphia, Pa	...	...
Whitney Elec. Inst. Co., Boston, Mass	...	...
Wagner Elec. Mfg. Co., St. Louis, Mo	...	...
Walworth Mfg. Co., 24 Oliver St., Boston, Mass	...	...
Wilder Fire & Burglar Alarm Mfg., Co., Chicago	A	6
Zucker & Levett Chemical Co., 14 Gd. St., New York	F	2

GOVERNMENT EXHIBITS.

Austria	Y	38
Brazil	W	4
Canada	P	6
England	O	5
France	Q 1, J 2, K 1, P 8	
Germany	X 1, 2 V 5, 6, D 1, E 1	
N. S. Wales	W	7
Russia	O	6
Spain	Y	39
Monaco	Y	8

Thermal Storage for Central Stations.*

BY GEORGE FORBES.

It has long been evident that storage of some kind might lead to great economy in central station work. The reason of this is that the demand for light has in most cities a maximum for only two or three hours of the day. Not only do we require to have the plant lying idle all the rest of the day, but the expense of working for these few hours is increased by its temporary character.

I have previously proposed that in a hilly country the boilers and engines should be working all the twenty-four hours, at the rate of the average demand, and that they should be used to pump water through a pipe to a high reservoir at least five hundred feet above the pumping station. At the lower end of the pipe turbines are placed driving dynamos. During day time the reservoir is being filled and in the evening it is being emptied. This produces a saving in boilers and the substitution of cheap turbines and a small number of efficient pumping engines for a large number of less efficient engines to drive dynamos. It also reduces the coal consumption from five pounds to three pounds per horse-power per hour. In a paper read last year before the British Association for the Advancement of Science, I showed that this plan could easily be adopted in Edinburg, in Scotland, the saving in capital and annual expenses being both very large. But it is not every city that has these advantages, and I wish now to introduce to your notice the excellent scheme which has been invented by Druitt Halpin, of Edinburgh.

He proposes to put up boilers only of the average capacity and to work them day and night. At times of light load the steam is carried through pipes into large iron reservoirs of cheap construction, and is used to heat the water in these reservoirs to a high temperature and pressure. When the heavy demand comes on in the evening, steam is drawn from these reservoirs. The losses of heat from radiation from the reservoirs can be made very small indeed, with proper lagging, in fact, quite imperceptible.

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* Abstract of paper read before the National Electric Light Association at St. Louis, Mo.

Mr. Halpin has worked out the relative cost of supplying machinery to the central station of Berlin (1) without any storage, (2) with storage batteries and (3) with thermal storage. He first selected this station because the output at each hour of the day all through the year was published before any other central station had published similar data. In this system there are four central stations, giving off about ten thousand electrical horse power.

The load at different times of the day is such as to lead to the following data:

Maximum load	7,500 kilowatts,
Mean load	2,030 " " "
Excess of max. above mean	5,080 " " "
Duration of ditto	7.5 hours

Now Mr. Halpin claims that he can replace 22 boilers for working in the ordinary way by five boilers and 92 of his storage cylinders, which are cheap to construct and have necessarily a small evaporation. His claim, which I must admit seems to be quite well founded, is that while laying out somewhat more capital on his plan he gets a very large return for the extra capital spent. He sums up the cost of the thermal storage system as follows:

Five Babcock & Wilcox boilers	$ 27,050.00
Boiler house	9,500.00
Chimney	4,850.00
Cylinder house	38,300.00
92 Cylinders	184,000.00
Total	$258,700.00

and he puts the cost under the existing system at $182,700.00.

Now if we charge ten per cent to annual depreciation of boilers and only five per cent. on iron cylinders, which really seems a very fair value, then the annual interest and depreciation comes out almost the same for both systems, thus:

EXISTING SYSTEM.

5 per cent, on $182,700.00 capital	$ 9,135.00
10 per cent. on $117,850.00, boilers	11,785.00
4 per cent. on $64,850.00, buildings	2,600.00
Total	$23,520.00

THERMAL STORAGE.

5 per cent. on $258,700.00 capital	$ 12,935.00
10 per cent. on $27,050, boilers	2,705.00
4 per cent. on $47,050,00 buildings	1,900.00
5 per cent. on $184,000, cylinders	9,200.00
Total	26,740.00

The annual charges against thermal storage are $3,220.00, but the annual saving in coal is, in this special case, 7,000 tons, besides the saving in ash removals and firing. Mr. Halpin thus obtains figures, giving an annual saving of $36,530.00 to pay interest on extra capital of $75,000.00, with coal about $5.00 per ton.

Now the only kind of storage against which Mr. Halpin has to compete, when high land is not available for utilizing water storage, is the storage battery; and from his figures, which seem fair to me, the extra capital required is $732,200.00, and the total annual extra cost, $170,750.00, which shows a great advantage in thermal storage.

I consider that all these figures are very conservative, and that in these days when we are learning to realize the importance of cutting down working expenses in central stations, this system must necessarily occupy an important place. But it is of peculiar interest to me, owing to its applicability to a kind of work to which I have devoted a large part of my time in the last seven or eight years. I refer to the burning of the house refuse and garbage in our cities. I find that from the house refuse of any town I can supply steam enough to generate electric light at the rate of one 16-candle power lamp per head of the population for two hours every night of the year. By doing this I am saving the municipality from $10,000 to $20,000 per annum per 100,000 inhabitants for the cost of removal of house refuse.

A Large Generator with Direct Connected Engine.

Through its charcteristic enterprise, Chicago is soon to have one of the largest generators for electric lighting in the country. We illustrate, in the accompanying cuts, an exceedingly interesting plant now under construction at the corner of State and Rush streets for the Shuman Electric Light Company. It consists of 750-horse power Stirling boilers, one 800-horse power Improved Greene engine of tamdem compound type, with the largest armature in this country directly connected to the engine shaft. This armature is of the Siemens & Halske type, and capable of generating current for 8,000 incandescent lights of 16-candle power each. The armature alone weighs 40 tons. A special car was necessary to transport it from New York to Chicago, it having been manufactured in Germany. The armature in this case acts as a balance wheel for the engine, while running at 100 revolutions.

In the construction of the engine some of the most expert and practical engineers have been interested. It is built under the "Rockwood System" of compound engines. High pressure cylinder 16-inch diameter; low pressure 35-inch diameter by 48-inch stroke, to have 150 lbs. boiler pressure and to run 100 revolutions per minute. The details of construction speak loudly for successful economy and durability. The main bearings are 14-inch diameter by 36-inch long, adjustable in all directions. The connecting rod is solid steel. The crosshead and crank pin 8x8½ inch. Wheelock Piston packing being used in the pistons.

The improvements made by Mr. N. T. Greene in this engine over the old style of Greene are very striking. He employs the flat slide valves of the grid iron pattern for both steam and exhaust, and operates them at right angles to the piston. The object of this is to do away with the "coffee mill," fixings usually attending the toggle movement in transmitting motion to the valve from a rotary spindle. In this new type the valves are never moved under pressure, the dwell being accounted for by the link operating pusher. Other valuable points have been introduced in this machine, which space prevents us from specifying. Suffice to say that this plant is considered of such import as to have Mr. N. T. Greene, the famous inventor and builder of the Greene engine since 1855, to leave Providence and go to Beloit, Wis., to personally supervise its construction, it being manufactured by the Williams Engine & Clutch Works, Beloit, Wis., for the California Engineering Co., Chicago, sole owners of the Greene engine patents, and who are making the installation for the Siemens & Halske Electric Company.

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[*] Abstract of paper read before the National Electric Light Association at St. Louis, Mo.

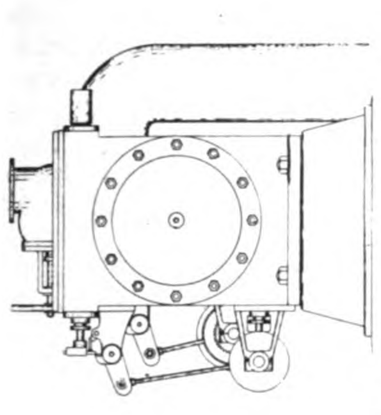

FIG. 3.—ELEVATION OF END OF CYLINDER.

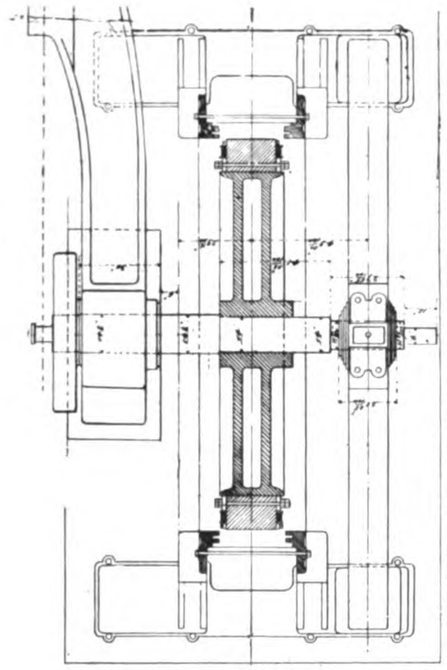

FIG. 2.—CROSS SECTION THROUGH AXIS OF ARMATURE.

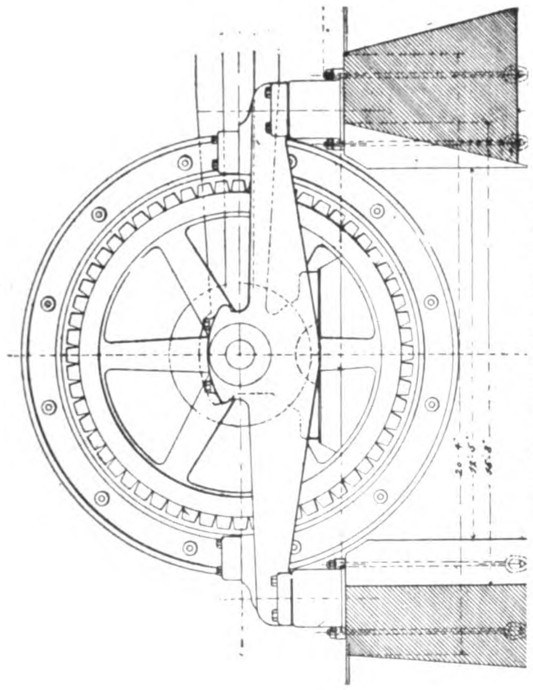

FIG. 1.—ELEVATION OF DYNAMO.

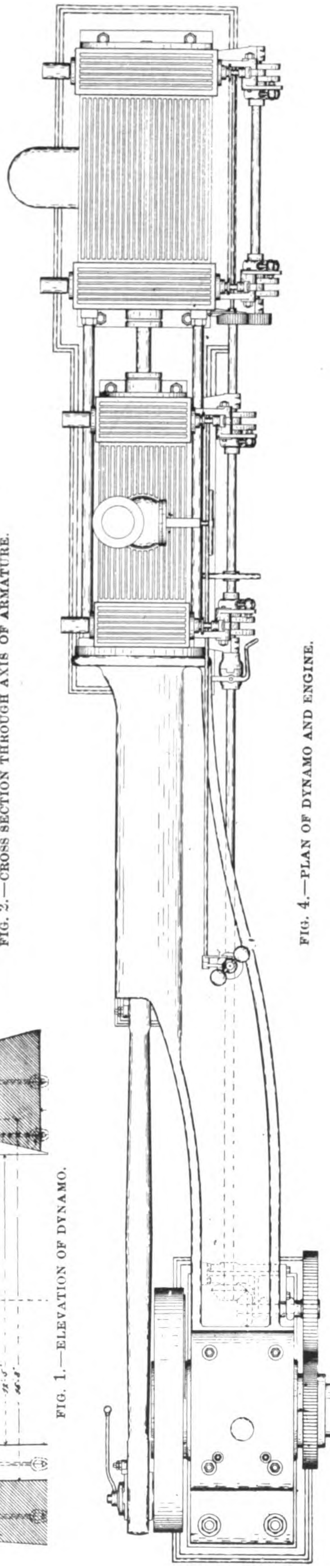

FIG. 4.—PLAN OF DYNAMO AND ENGINE.

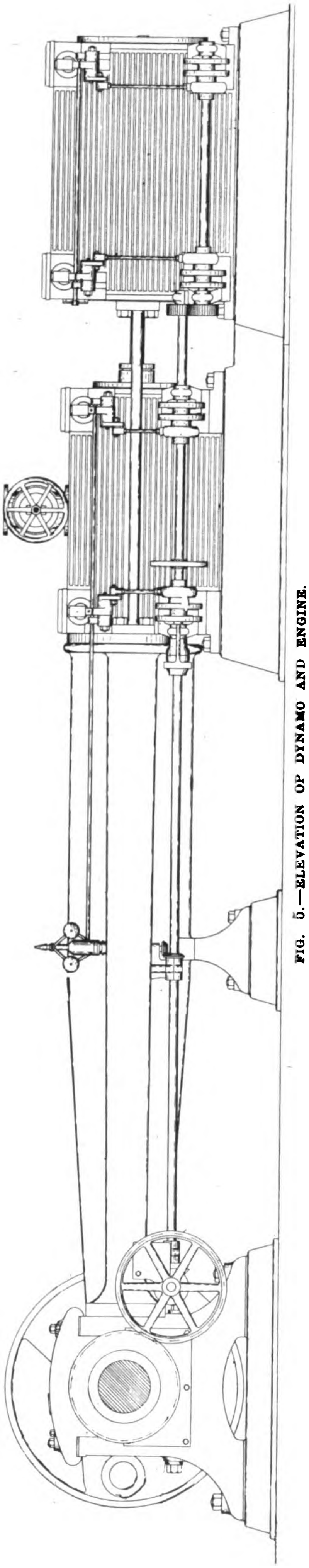

FIG. 5.—ELEVATION OF DYNAMO AND ENGINE.

LARGE GENERATOR WITH DIRECT CONNECTED ENGINE.—Built for the Shuman Electric Light Co., Chicago.

Electrical Industries.

Entered at Chicago Postoffice as second-class mail matter.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.
Advertising Rates upon application.

The tendency of the present age toward large corporations finds another example in the New England Street Railway Company. According to the prospectus issued by the company it proposes to acquire and operate street railways in New England and already owns several roads in Massachusetts and Connecticut.

At a meeting of the Chicago Electric Club held on March 20th, a very interesting paper was read by Mr. J. K. Pumpelly on "the present status of the storage battery." Mr. Pumpelly exhibited a storage battery devised by himself which stood a very credible test made by the members of the club.

ALTERNATING CURRENT MOTORS.

That the alternating current motor is fast coming to the front for power purposes is clearly shown from the number of different machines either nearly or quite ready for the market, some of which are illustrated in our current issue. Much experiment has been necessary to bring this type of motor to where it would meet all the requirements of the service and it is certainly encouraging to note the progress that has been made in perfecting a machine whose field of usefulness has long been recognized. The large number of central stations throughout the country operating the alternating system will be liberal purchasers of these motors provided all the conditions have been met.

THE ST. LOUIS CONVENTION.

The sixteenth convention of the National Electric Light Association, held in St. Louis February 28 to March 3, passes into history as one of the most successful meetings yet held by that organization. The attendance was good, and the interest manifested fully up to the standard. The papers read, while perhaps fewer in number, were none the less valuable and instructive. They are all of them worth attention, and our brief review of them will, we believe, repay the reader. The papers that probably attracted the greatest interest were those by Prof. Forbes on "Thermal Storage for Central Stations" and "The Incandescent Lamp from a Commercial Standpoint," by Calvert Townley, the discussion following the latter upon the present lamp situation being very spirited and interesting. The event, however, of the convention, from a scientific point of view, was undoubtedly the lecture given by Mr. Nikola Tesla. This lecture will be a most memorable one in the history of the association, from the fact that never before was so large and enthusiastic an audience ever gathered together to listen to a lecture on an electrical subject. The proverbial hospitality of St. Louis was more than demonstrated by the generous welcome and treatment received by the delegates and their friends at the hands of President Ayer and his committees. It will always be remembered as a meeting of great pleasure and profit by those who were fortunate enough to attend.

THE TELAUTOGRAPH.

A most important event of the past month was the formal public exhibition by Prof. Elisha Gray of his telautograph. This ingenious piece of mechanism which has occupied a large proportion of the inventor's attention for the past few years attracted, as might be expected, much attention from the public and the tests made, it is unnecessary to say, were highly satisfactory. Prof. Gray occupies one of the most important places in the electrical field today and although in middle life looks forward to many years more of study and work in this field. His connection with the invention of the telephone is well known, it being a point of dispute whether he or Prof. Bell was the inventor. This latest triumph of Prof. Gray's, however, is one of the wonders of the age. It will not only enable people to send messages in their own handwriting; but will be useful in newspaper work, in drawings, plans, etc. The instrument itself is a wonder mechanically and will no doubt take a high position along side of the telegraph and telephone. The illustrations given on another page will be read with great interest as the advent of the telautograph is a thing long looked forward to with much expectancy.

THE RESIGNATION OF FREDERICK SARGENT.

Among the events of last month in connection with the World's Fair, the one most to be regretted was the resignation of Mr. Frederick Sargent from the general management of the electrical and mechanical engineering department. The position which Mr. Sargent held it is agreed was one of the most difficult and trying of any connected with the exposition and his resignation it seems was made necessary through the restrictions placed upon him and his departments in regard to certain rules and regulations which he found impossible to conform to and get his work completed at the time set for the opening. The work in these departments has been delayed by these restrictions and he could not well do otherwise than step out. The two years of hard work which he has given to the fair has been fraught with difficulties hard to appreciate and it is no wonder that mistakes should have occurred. In fact it would seem to us as a matter of course that mistakes could not be avoided but we believe that no one did his work more faithfully or conscientiously than Mr. Sargent. The power station, however, which he has laid out and nearly completed and which will be the wonder of all visitors during the continuance of the fair will stand as unmistakable evidence of his ability. It is indeed a matter of great regret that the exposition should lose the services of Mr. Sargent for it is certain that it had no more efficient servant than he.

THE WESTERN UNION TELEGRAPH COMPANY'S NEW PRESIDENT.

At the meeting of the directors of the Western Union Telegraph Company March 8th, General Thos. T. Eckert was elected president of the company to succeed Dr. Norvin Green deceased. The election of General Eckert was generally expected as he has been for several years the vice-president and general manager of the company.

General Eckert was born in St. Clairsville, O., April 23rd, 1825. He was one of the first to learn telegraphy, and in 1852 he was appointed superintendent of the Union telegraph lines. Soon afterward he entered the service of the Western Union. In 1861, Mr. Eckert was placed in charge of the Military Telegraphs in the army of the Potomac with the rank of captain and assistant quartermaster. In 1862 he established at Washington the military telegraph headquarters at the war department being promoted to the rank of major. In 1864 Major Eckert was made lieutenant-colonel and after that invested with the rank of brigadier-general. About this time he was also appointed assistant secretary of war a position he held until August, 1866, when he resigned to take the general superintendency of the eastern division of the Western Union Telegraph Company. General Eckert performed these duties up to 1875. He was in 1876 made president of the Atlantic & Pacific Telegraph Company, a company organized as a rival of the Western Union. Under his management this company made such a showing that the Western Union company became alarmed and after a meeting of the officers a consolidation was effected. He was made first vice-president and general manager, a position which he held until the time of his election to that of the presidency. General Eckert is a man of great executive ability and a strict disciplinarian. His appointment to the presidency is the strongest possible that could have been made.

The American Street Railway Association.

The executive committee of the American Street Railway Association announces that the Milwaukee Industrial Exposition Building has been secured for the exhibition of supplies and manufactures of every nature used in the street railway business, in connection with the twelfth annual meeting of the association, to be held in the city of Milwaukee, Wis., commencing the third Wednesday in October, 1893, and lasting three days. The building has been engaged for two entire weeks, beginning October 9, and ending October 23; thereby giving ample time for the setting up and removal of the largest and heaviest exhibits.

The hall for the meeting is also in the same building on the second floor, and delegates will be enabled to examine the exhibits with much greater satisfaction than heretofore, on account of the nearness of the meeting hall to the exhibits.

Applications for space must be made on blank forms, which can be had with rules and regulations, and all other information from Mr. Wm. J. Richardson, secretary, 166 Montague St., Brooklyn, N. Y.

It is the intention to make this year's exhibit by far the most interesting of any yet seen. A cordial invitation is extended to all manufacturers and producers of street railway supplies to exhibit their machinery and wares, if possible in process of manufacture.

The following are the subjects for reports at the next meeting:

Best Method of Lighting and Heating Street-Railway cars.—G. F. Greenwood general manager Allegheny & Manchester Traction Co.

Can the Trail be satisfactorily used in Paved Streets?—C. Densmore Wyman, vice president, Central Park, North & East River Railroad Co., New York City.

Direct Driven Generators.—C. J. Field, electrical engineer, New Jersey Traction Co., Newark, N. J.

Power House Engines.—E. G. Connette, superintendent United Electric Railway, Nashville, Tenn.; L. H. McIntire, electrical engineer, Atlantic Avenue Railroad Co., Brooklyn, N. Y.; F. S. Pearson, electrical superintendent, West Ends Railroad Co., Boston, Mass.

Standards for Electric Street Railways.—O. T. Crosby, Boston, Mass.; Charles W. Wason, Cleveland, O.; L. H. McIntire, Brooklyn, N. Y.; Thos. H. McLean, New York City; C. G. Goodrich, Minneapolis, Minn.

Storage Batteries in Connection with Central Stations for Utilizing Surplus Energy for Lighting or Power.—C. O. Mailloux, electrical engineer, Metropolitan Railroad Co., Washington, D. C.

Morals of Corporations.[*]

BY E. A. ARMSTRONG.

The quasi-public character of much of the business of almost every electric light company in its dealing with municipal authority must be emphasized. Every company doing such service occupies such a position of trust as to require it to give a maximum of service at a minimum of cost. Don't misunderstand me. It is not only the privilege of an electric company to receive, it is its duty to demand fair compensation for what it provides and furnishes. It is just as dishonest for it to take advantage of its position and crowd the municipality as it is for the municipality to reverse the tables. We have often taken occasion to complain of the unfair treatment given companies by municipalities, but too often the treatment had been invited. When a corporation, such as ours, make a large investment for public lighting, and while it continues to regard what I have indicated as its duty regarding service and charges, it has the right to expect a continuence of the municipal-patronage, I was about to say, service I will substitute. Any deviation from this, while not a violation of an express, is the violation of an implied, contract; something in law just as binding when defined, and, therefore, surely ought to be in morals.

I imagine I might amplify this to a considerable extent, but I will not, further than to say what applies to corporations acting with each other and with individuals, as may hereafter be stated, will all apply, and really with more binding force, upon the relation with the municipal or governing corporation. Such a corporation being a part of the governing machinery, it is bound in law, as well as in justice, to treat with absolute fairness every person alike.

That there is, to a wonderful extent, this appreciation of obligation on the part of the companies is a thing very pleasant to contemplate. If accident or disaster happens to a company, see what heroic effort is put forth to remedy it.

It is the duty of our corporation to use the best methods it knows or can learn, adopt all the improvements, and render the best possible service, and that at as reasonable a figure as it can afford to do it, having a just appreciation of the risk the capital invested sustains, which is entitled to an adequate return. If you can furnish light or power at a less figure that you are now receiving, and still pay your stockholders a fair return, it is your bounden duty to voluntarily reduce your prices, so that those who make your business possible may have their share in your prosperity.

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[*] Abstract of paper read before the National Electric Light Association at St Louis, Mo.

Long Distance Tranmission of Power.*

BY CHARLES S. BRADLEY.

For the electrical transmission of power we have two general systems—he alterntating and direct. The multiphase alternating was advertised extensively by the Lauffen-Frankfort plant in 1891. This pioneer plant was built by much sacrifice of time and money, and we owe gratitude and honor to these men whose indefatigable efforts accomplished the beginning of an art which is destined to revolutionize the social status of mankind. This plant proved conclusively that very high voltages could be successfully used and the insulation maintained.

The multiphase alternating is the most pliable, adjustable system that has ever been conceived. It is capable of transformation in voltage; will supply motors of either synchronous or non-synchronous type; will readily convert in motor transformer to direct current for electric railroad or direct current distribution, and thus supply direct current motors.

Where the power is to be delivered in compact form the direct current offers some important advantages. We can get very high voltages by a battery of machines placed in series for the generator and motor stations. The placing of machines in series for power transmission was proposed by Mr. Edison is 1880 and Prof. Thomson in 1883. Each contributed some essential improvement, but it is evident that the enormously high voltages now contemplated were not then thought of. For the generator station I prefer compound wound machines: first, that the system may be self-regulating; second, that the series coil when a machine is thrown into action shall magnetize the field in the right direction; this also requires that the switch shall close the series coil first. The shunt coil would tend to reverse until the machine has attained electromotive force enough to overcome the resistance of its own armature. In order that each machine should be as far as possible independent of its neighbors, I prefer that it shall be short shunt, or in other words, the shunt coil be charged direct from the brushes of each machine. I would use the 500 volt machines, and of such ampere capacity as the size of the plant demanded, and belt them all from one shaft. The 500 volts have been found safe to life, and the commutator works well. Now, we must protect the insulation of the windings; the end machines where the terminal voltage, say, reaches 20,000 volts may, in case of grounds, be subjected to the piercing strain of the entire electrical pressure. It is impracticable to insulate the windings of each machine to stand any such potential; therefore, we connect the windings of the machine at some point with the frame so that it may never be subjected to a strain greater than its own voltage; next each machine foundation is thoroughly insulated from earth, and, in case this insulation fails for any reason, the fuses of the line will be blown, thus protecting the whole structure.

At the motor station we use simply 500 volt shunt machines with the same precautions as at the generator station. Our power having been transmitted can now be converted into whatever may be demanded. If it is an electric system of distribution, we shall have the advantage of its being impossible for the high tension current to get into the system of distribution. If it is a large plant, the motor station may be subdivided into two or three parts; preferably in multiple arc, with the same potential on each. On very long lines I think the transmission must be done by direct current.

Remarks Concerning Power Transmission from the Economic Standpoint.*

BY L. B. STILLWELL.

The question which the practical man asks as to the economy of a project is the most difficult to answer. Very few men, even among those who are actually operating central stations, are able to say exactly what power costs them, and it is not surprising that the engineer who is called upon to lay out, let us say, an elaborate plan for the utilization of water power finds it difficult to give explicit answers to questions relating to the cost of operating such a plant, probable revenue to be derived from the sale of power, and, in general, economic feasibilty. The best way to arrive at results of some tangible value is obviously to compare an hydraulic and electric transmission plant with a central station using steam engines to drive dynamos.

We may conveniently construct an algebraic skeleton or framework of the annual charges against each of these typical installations. When we come to translate algebra into arithmetic by substituting numerical figures for the algebraic symbols, opinions will differ widely as to the actual values of the different factors, but I think that the skeleton will be useful, as by discussing, and, if possible, fixing one factor at a time, we shall be better able to arrive at some approximation to a definite and tangible result.

In calculating the annual charges against the steam and electric plant we must consider the following:

Fb = First cost of real estate and buildings.
Pb = Percentage covering interest upon and maintenance of real estate and buildings.
Cb = Constant expenses, taxes, insurance, etc., on real estate and buildings.
Fs = First cost of complete steam plant, including engines, boilers, steam pipes, pumps, heaters, etc., installed.
Ps = Percentage covering interest upon and maintenance of steam plant.
A = Cost of fuel to produce one pound of steam.
S = Pounds of steam used per indicated horse power per hour.
N = Number of indicated horse power hours used per year.
Ws = Cost of water (if any) per annum.
Os = Cost of oil and waste per annum for steam plant.
Fe = Cost of electric generating plant, including exciters, regulators and complete station equipment.
Pe = Percentage covering interest upon and maintenance of electric generating plant.
Oe = Cost of oil and waste per annum for electric plant.
Cse = Constant expenses including superintendence, wages, taxes, insurance, etc., steam and electric plant.

Then, $PbFb+PsFs+ASN+Ws+PeFe+Os+Cse+Oe$ $=$annual charges.

For the hydraulic and electric plant we have the following:

Fb = First cost of real estate and buildings.
Pb = Percentage covering interest upon and maintenance of real estate and buildings.
Cb = Constant expenses, taxes, insurance, etc., on real estate and buildings.
Fh = First cost of hydraulic plant, including turbines, dams, flumes, etc.
Ph = Percentage covering interest and maintenance of hydraulic plant.
Oh = Cost of oil and waste per annum for hydraulic plant.

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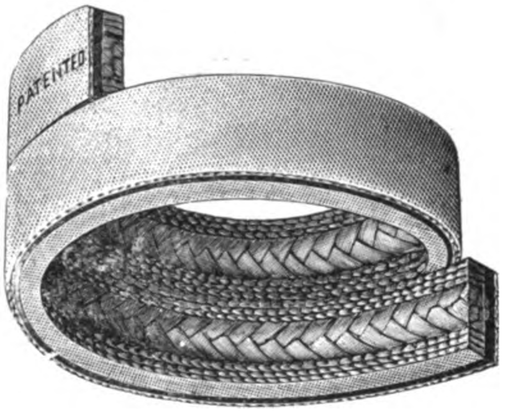
* Abstract of paper read before the National Electric Light Association at St. Louis, Mo.

*Abstract of paper read by Calvert Townley before the National Electric Light Association, St. Louis, Mo.

Ch = Constant expenses, including superintendence, wages, taxes and insurance on hydraulic plant.
A = Cost of water per horse power hour (where water rate is paid).
N = Number of horse power hours at turbine used per year.
Fe = First cost of electric apparatus between turbine and local distributing circuits exclusive of line.
Pe = Percentage covering interest upon and maintenance of electric plant exclusive of line.
Oe = Cost of oil and waste per electric horse power from generators for electric plant.
Ce = Constant expenses, including superintendence, wages, taxes, insurance, etc., on electric plant.
Fl = First cost of pole line, insulators and conductors.
Pl = Percentage covering interest upon and maintenance of pole line, insulators and conductors.
Cl = Constant line expenses (supervision and repairs.)

Then, $PbFb+Cb+PhFh+Oh+Ch+AN+PeFe+Oe+Ce+PlFl+Cl=$ annual charges.

And now, what have we accomplished? We certainly have not arrived at a definite solution of the problem of comparative annual charges, and the more carefully one looks at the statements, the more evident does it become that there are many factors the value of which can only be fixed by actual experience. It appears, however, that were we in possession of accurate and detailed data as to the cost, operating expenses and income of a steam and electric plant, we might form a pretty accurate idea of the practicability of an alternative project involving electric transmission of power. We should also need some information as to the cost of installing and operating hydraulic plants under various conditions, but this can be obtained with sufficient accuracy and with no great difficulty.



GOODSELL'S PACKING.

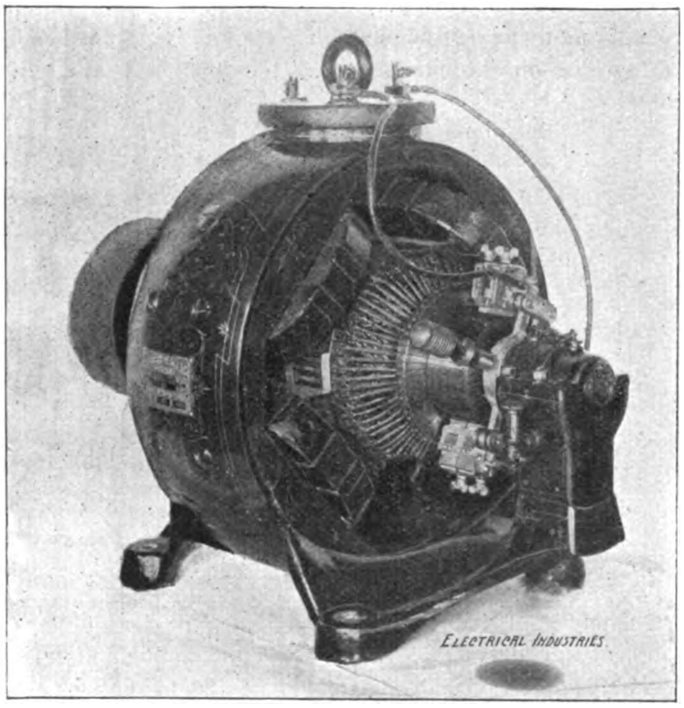
Goodsell's Packing.

The Goodsell Packing Company, Chicago, Ill., has brought out a new rod packing as shown in the accompanying cut. This packing consists of alternate coils of braided flax and cotton duck placed side by side in their bearing upon a piston or valve rod, the whole being backed with a rubber cushion and formed into strips or coils ready for application. The uniting of these two fibres affords complete protection to each in service. The braided flax acts a suitable reservoir for lubricating materials, ensuring constant contact with the rod and regulated by the gland pressure, the firmer cotton fibre receiving its share of the wear and properly protecting the flax. The rubber cushion which is placed on the outside of the wearing surface gives the proper elasticity to the packing, thus preventing friction and rigid bearing.

New Slow Speed Motor.

The motors manufactured by the Western Electric Company are especially designed to run at a very slow speed, and the weight efficiency and commercial efficiency are both maintained at a remarkably high point considering the slow speed at which the motors are designed to run. The regulation is entirely automatic, and the speed is maintained uniform throughout the entire range of load, the difference between full load and no load being less than 5 per cent. The motors are of the divided bi-polar field type, and provided with an armature of the same type.

The construction throughout is so simple that repairs can be made with ease. In the application of this type of motor, for driving machinery which has to run at moderately slow speeds, and where with the ordinary type of high speed motor a considerable amount of reducing gear has to be used, a considerable saving in power results, owing to the reduction in the amount of gearing necessary, due to the very slow speed of the motor. For this and other reasons, this motor is peculiarly adapted for use on cranes, derricks, hoists and other machinery of a like nature. The motors are wound to suit any voltage from 100 to 500, and are provided with non-combustible starting boxes. When so ordered they can be provided with a reversing gear, enabling them to be run in either direction.



NEW SLOW SPEED MOTOR.

The Calumet Electric Manufacturing and Engineering Company, Chicago, was recently organized for the purpose of manufacturing and trading in general and electric machinery besides doing a general engineering business. At a meeting of the stock holders the following board of directors was elected: Dr. H. H. Deming, Chas. T. Otis, L. A. Hine, L. J. Otis, and G. E. Dorman. The officers elected are as follows: L. A. Hine, president and secretary; L. J. Otis, treasurer; G. E. Dorman, vice-president. Mr. L. A. Hine, the president, is a man of good technical education and has had considerable experience as an engineer and chemist besides being well informed on electrical matters. Mr. J. L. Otis is a young man well known in real estate and business circles in Chicago. Mr. G. E. Dorman is well known in electrical circles as the designer of several familiar types of dynamos and motors. The company has equipped a new shop at 174 S. Clinton street and has begun the manufacture of fan motors of any voltage up to 500-volts and from 1-5-horse power with a 15-inch fan to 1-16-horse power motor with an 8-inch fan. The 1-8 and 1-12-horse power fan motors are equipped with 12 and 10-inch fans respectively. These motors will be known as the Calumet fan motors. The company announces that it will manufacture only first class goods. At present the company has in course of construction two dynamos of a new type; also electric emery wheel, burnishers and a ceiling fan motor.

Electric Motors Operating on Single Phase Alternating Current Circuits.

BY ELIAS E. RIES AND GORDON J. SCOTT.

In view of the discussion that has recently taken place in reference to alternating current motors, both on this and the other side of the water, we desire to announce through the columns of the electrical press, that for the last year and a half we have given a great deal of attention to the question of power transmission by the use of the commercial alternating circuits now in use. The subject has been dealt with on circuits, the frequency of which varied all the way from 200 to 40 cycles per second. Some very interesting and useful facts have come to light, and our experiments have shown, that practical alternating current motors of any size, can be built and operated at the ordinary frequency of 138 cycles per second, or even at higher freqencies, with a commercial efficiency equal to any direct current motor.

This has been fully demonstrated by experiments made upon a motor in the factory of the Ries Electric Specialty Company, which develops nearly two horse power at the slow speed of 360 revolutions per minute. The total weight of this motor is just 66 pounds; there are only two pounds of copper on the machine, and it shows a commercial efficiency of 85 per cent when run upon an ordinary incandescent lighting circuit of 50 volts at a frequency of 138 cycles per second.

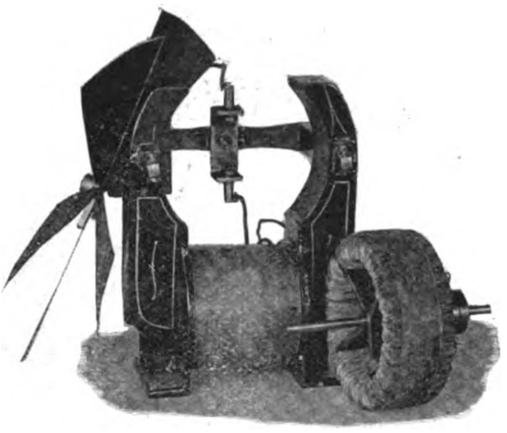


FIG. 1.—NEW FAN MOTOR.

The motor referred to is built upon entirely new lines, and is radically different from any of the types of alternating motors so far described. The motor operates without the use of condensers, reaction devices, secondary batteries, or similar paraphernalia for changing the lag or phase. We intend to turn out in a short time, in addition to this type, an entirely new and novel single phase motor of high efficiency, having a completely closed magnetic circuit, and as a consequence a very small magnetizing force.

For electric railway work, we have a special form of this motor under way, which will have a variable speed with maximum torque, a feature that has not heretofore been possible, either with direct or alternating current motors, although numerous attempts have been made by various well known inventors to produce this desirable result in direct current practice, by the use of motor generators, differential gearing, and other equally complicated devices. The Ries & Scott railway motor of this type, will be of 20-horse power, and will weigh when completed about 600 pounds, which is less than one half of the weight of direct current railway motors, thus combining great starting effort with low consumption of energy and with very light weight.

Owing to patents pending, we cannot enter into fuller details at present, but can state that we will in a few months, place upon the market a reliable self-starting, synchronons or non-synchronons alternating current motor fully equal, if not superior, to any direct current motor that has been built. This motor will not only solve the difficulty that has thus far been encountered in utilizing single phase alternating currents for operating stationary motors of all powers, but will also render it commercially possible to employ the alternating current for electric railway work, on a scale that will render the system, for economy in transmission and regulation, to say nothing of increased safety and freedom from repairs, far superior to the direct current electric railway practice of today.

New Fan Motors.

We illustrate herewith two types of motors, which are distinctively new, manufactured by the Calumet Electric Manufacturing & Engineering Company, Chicago. A special feature of these motors shown in Fig. 1 is the large size of the armature, permitting the better insulation of its various parts, the advantage of which can be readily seen in a machine designed for a high potential. This armature has numerous coils and commutator segments, and in its operation, it is claimed, is absolutely sparkless. Another important feature of the machine is the brush holder. The brush holder consists of a small tube within which is a spring against which the brush presses when inserted in the holder, the brush consisting of a small pencil of carbon. The machine is supplied throughout with self-oiling lubricators.

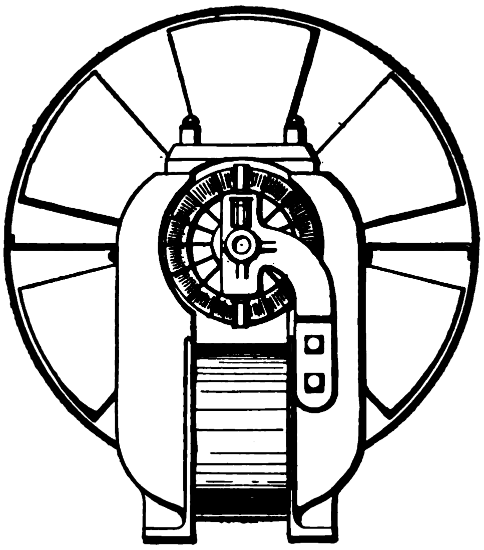


FIG. 2.—NEW FAN MOTOR.

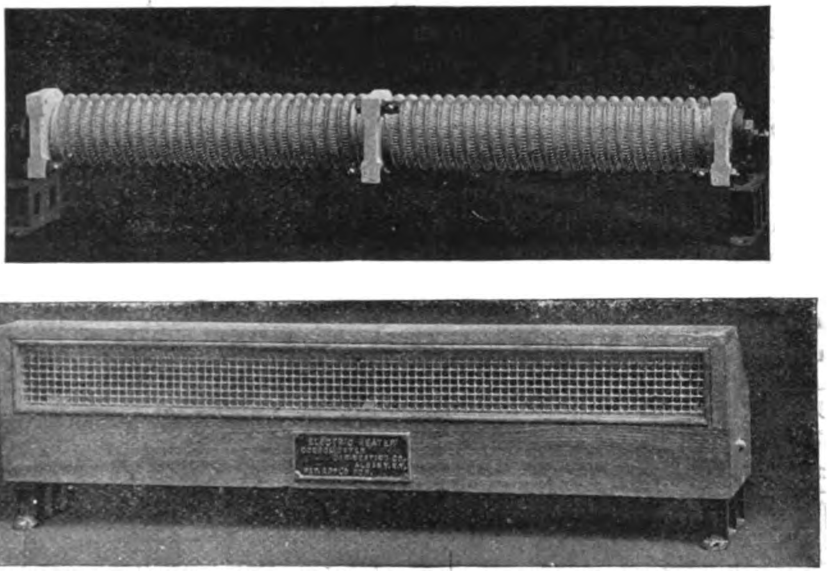
These machines are manufactured in sizes for 110 and 220 volt circuits of 1-16, 1-12, 1-8, 1-5 and ½-horse power, and for 500 volt circuits 1-8, 1-5 and ½-horse power. The company has also in process of construction several larger dynamos and motors. Fig. 1 represents one of the motors designed for a 110-volt circuit, and Fig. 2 a motor designed for a 500-volt circuit.

The exhibit of the Bell Telephone Co. will be one of the most interesting at the Fair.

The C. C. H. Company's Electric Heater.

A very efficient and well constructed car heater is manufactured by the Consolidated Car Heater Company of Albany, N.Y. Mr. James F. McElroy, who is now consulting engineer of the company, is the inventor of this heater.

Each heater consists of a porcelain insulator mounted on a square iron rod five eighths of an inch in diameter. A spiral groove is formed on the surface of this porcelain insulator which extends its entire length. The conductor which offers a considerable resistance to the passage of the current is drawn in this groove. At the ends of the insulator are glazed porcelain plates with binding posts, to which the ends of the conductor are attached. Each heater is divided in the center by a porcelain plate so as to give a greater number of combinations, thus permitting more perfect regulation of the heat. The iron rods which carry the porcelain insulator are supported on cast iron brackets which fasten the heater to the floor of the car. These supports also furnish a means of securely attaching the covering box. This covering box is made of wood, of any kind or finish desired, lined throughout with asbestos milled board. In the front of the box is a grated opening permitting the free circulation of air.



FIGS. 1 AND 2—C. C. H. CO'S ELECTRIC HEATER.

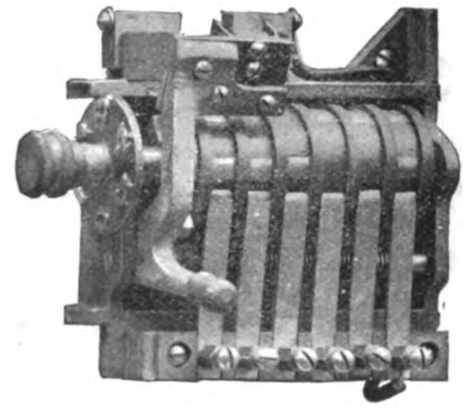


FIG. 3—C. C. H. CO'S SWITCH.

All parts are thoroughly insulated and between any two parts near each other there is but a slight difference of potential. A galvanized wire, which has the advantage of not oxidizing readily even when a high temperature is maintained, is used for the resisting conductor. A comparatively low temperature is carried in the conductor, so that there is no danger of oxidation. The car heater is so simple in construction that any repairs can be quickly and easily made.

Six heaters are placed on each side of the car beneath the seat. The advantage of this is readily seen. The heat is evenly distributed throughout the car and being placed near the floor warms the lower part of the body as well as the upper. When the car is provided with paneled risers, the heater is placed within the riser and the front of the heater with its grated opening take the place of the panel.

The electric switch, which controls the current, and consequently the temperature of the car, has six positions making six combinations of the heaters in the car. The construction of the switch is shown in the accompanying illustration. It consists of a cylinder of non-conducting material, on the surface of which are metal contact pieces through which the connections are made. The wires necessary to make the several combinations of the heater are connected to binding posts in the switch from which connection is made to the contact pieces in the cylinder by spring plates resting against the cylinder. Attached to one end of the cylinder is a notched wheel, the notches corresponding to the six combinations of the switch. A

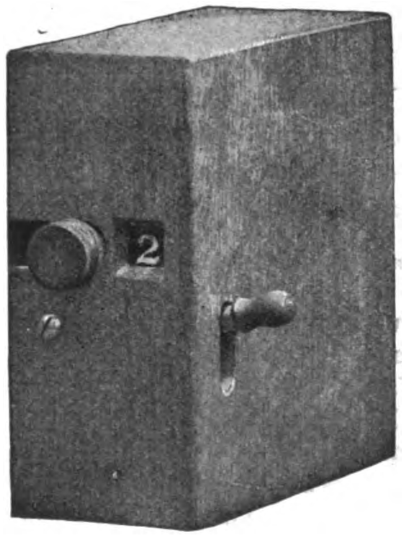
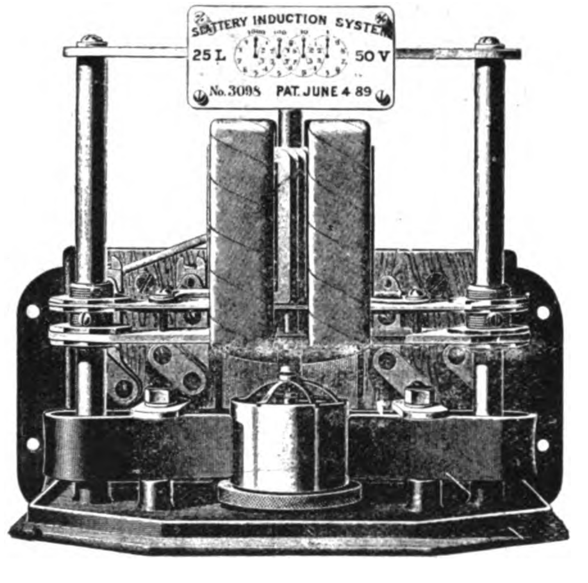


FIG. 4—C. C. H. CO'S SWITCH.

rock shaft is provided carrying a lever at one end, at the side of which is a lug fitting into the notches of the wheel. When the lever is pushed forward to its normal position the lug fits into the notches of the wheel preventing the cylinder from turning. By throwing the lever back the lug is withdrawn permitting the cylinder to turn freely. At the end of the lever is a U shaped piece of metal which closes the circuit from the trolley to the switch. When the lever is withdrawn the circuit is broken permitting the cylinder to be moved with no danger of sparking across the face of the cylinder. The shaft of the cylinder and also the end of the lever project beyond the covering of the box so that they are always accessible. Through an opening in the case, the markings on the end of the cylinder, indicating the amount of current in use are shown.

As to the cost of heating a car by electricity, the cost will of course vary with the amount of current consumed. The method of arranging and combining the heaters employed by the manufacturers permits of economical use of the current. The least amount of current on a 500-volt circuit that can be used is two amperes which can be increased to twelve as the occasion demands. The company believes the cost will not exceed one half cent per ampere hour. The weight of the complete apparatus for a car is a trifle less than 150 pounds.



RECORDING ALTERNATING CURRENT METER.

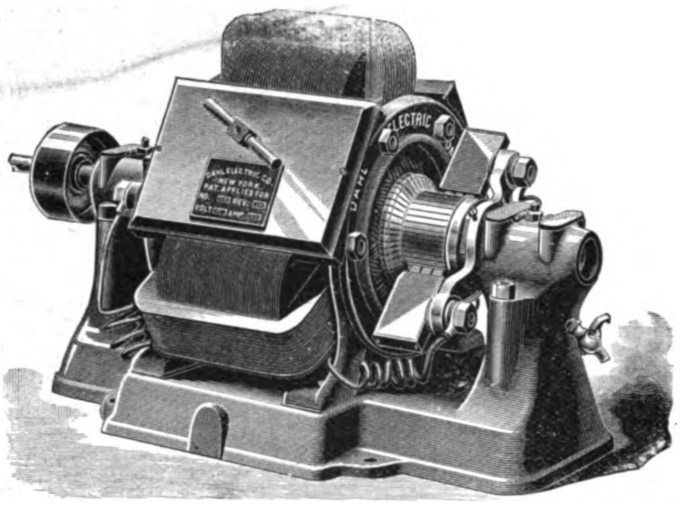
A Recording Alternating Current Meter.

The construction of a recording alternating current meter, manufactured by the Fort Wayne Electric Company, Fort Wayne, Ind., is shown in the accompanying illustration. It is a well made meter and sensitive, recording accuratety under a light as well as under a heavy load. The readings are direct and may be taken either in lamp hours or in ampere hours. The binding posts are plainly marked so that no accidents should occur from wrong connections. By means of a device, which raises the shaft from its jeweled bearings and holds it rigidly when the meter is not in use, the meter may be carried without danger of injury.

The Dahl Alternating Current Motor.

Mr. Olof Dahl, of the Dahl Electric Company, 120 Liberty street, New York, has produced a motor which can be connected to any of the existing alternating systems. These motors are self exciting and start with a torque it is said almost equal to their normal capacity. They are made in sizes from one horse power upward.

The one horse power motor has an efficiency of 75 per cent and in the larger sizes the efficiency increases with the sizes of the motor up to over 90 per cent. The field and armature coils do not heat to 30 degrees above the surrounding atmosphere under a normal load and there is no heating of the field cores. It has been shown by tests that even should an armature be stalled, which does not occur till the motor is 50 per cent over loaded, no serious heating of the coils takes place, the current being choked back by self induction. The motor is designed to operate on the alternating current with no reduction in the number of alternations.

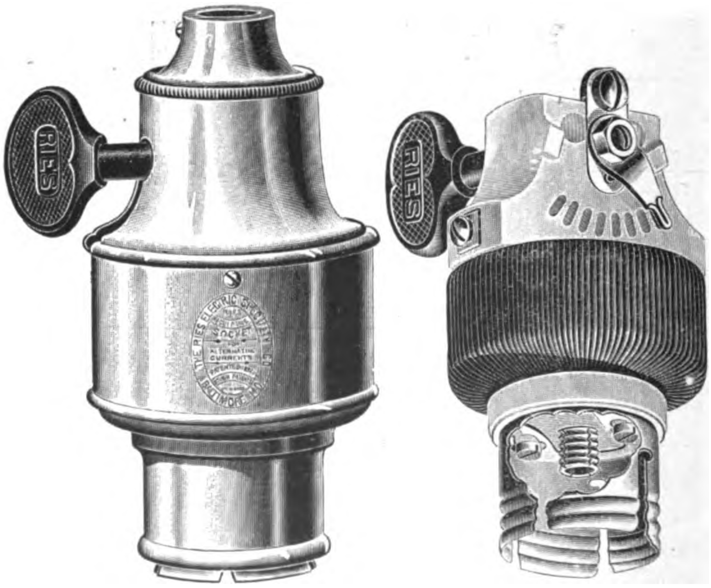


DAHL ALTERNATING CURRENT MOTOR.

Several of these motors are now in use. The accompanying illustration shows one of them from which its general construction will be readily seen.

The Ries Improved Regulating Socket.

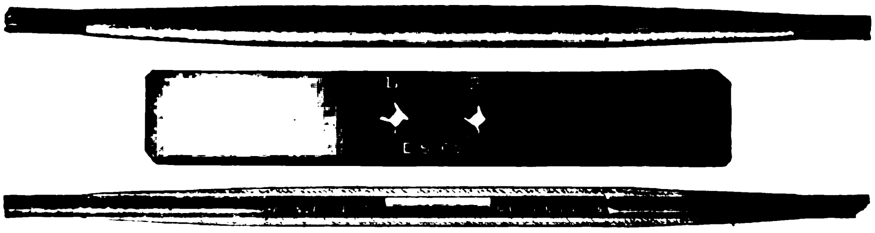
The Ries Electric Specialty Company, Baltimore, Md., has placed on the market an improved regulating socket which is illustrated in the accompanying cut. This socket is designed for only the alternating current and cannot be used on the direct.



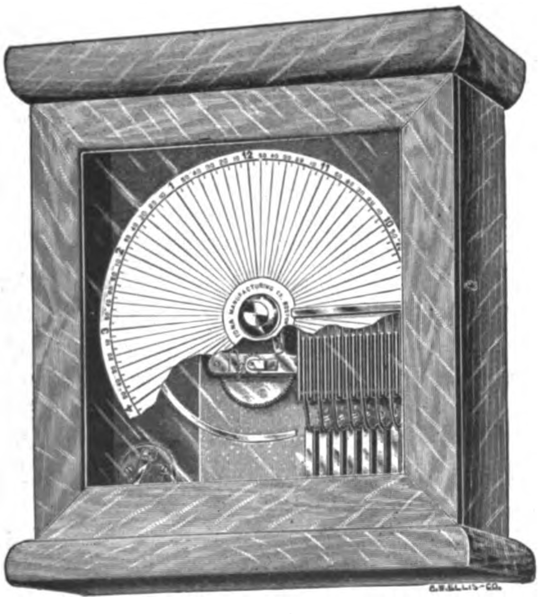
RIES IMPROVED REGULATING SOCKET.

The current is regulated by a small coil placed within the socket which sets up a counter current cutting down the supply of the lamp. The substitution of a porcelain supporting block in place of the former wooden one, the improvement in the coil and the adoption of a universal socket have made the socket much superior to those before manufactured. The reaction coil is very finely constructed. It consists of a small finely laminated annular iron core 1¼ inch wide, ¾ inch high, built up of thin iron rings carefully put together.

This core is wound by hand with a silk insulated cable composed of seven separably insulated copper wires varying in size according to the maximum current each is to carry. After the core is wound the ends of the wires in the cable are separated and the insulation removed. The end of each wire is then threaded through a double set of holes in the porcelain supporting block in such a manner that where the copper terminal pins are put in, the several wires will be connected in series, the winding being divided by the contact pins into seven sections. The socket key has contact arm attached which passes over the series of terminal pins on the face of the block. By turning the key so that the arm passes over a greater or less number of pins the light is diminished or increased.


WOOD'S SPLICING TUBE.

Another improvement is the use of the universal socket, adapting the same socket to any style of lamp. In this universal socket the center contact for the Edison socket is a small stud, hollow to receive the center pin of the Sawyer-Man or Westinghouse lamp and provided with a thread on its outer surface for the standard Thomson-Houston. This stud is slotted to accommodate itself readily to the various forms of lamps and to give a good electrical contact. The sides of the socket are also slotted giving it sufficient elasticity to fit the different makes and sizes of lamps.


IONA WATCHMAN'S REGISTER.

Its compactness, simplicity and the ease with which it is operated are points which commend it to the trade.

The Iona Watchman's Register.

A highly finished and neatly designed watchman's register, which is being placed on the market by the Redding Electric Company, 41 Federal street, Boston, Mass., is shown in the accompanying cut. This instrument is made with great care and especial attention is given to perfecting each part. The mechanism is enclosed in a highly polished dust proof case, which is made in various natural woods.

The novel features of this system consist mainly in the gravity operating mechanism combined with a printing record made by magneto operated magnet. This printing feature makes a record that cannot be counterfeited, imitated or effaced. This magneto system does away with all the annoyance attending the use of batteries. Time movements are furnished, at a small extra cost, when desired.

Wood's Splicing Tube.

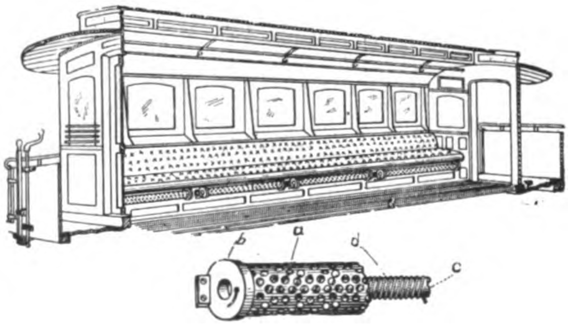
The accompanying cut illustrates a connector for splicing trolley wires manufactured by the Ansonia Electric Co., Chicago.

The connector is made in one piece threaded on the inside with the right and left hand threads. A tool for cutting the threads on the trolley wire is furnished with the connectors, by the aid of which the connector is quickly and easily adjusted to the trolley. The gradua tapering of the connector toward the ends permits the trolley wheel to pass over it smoothly and without sparking.

At a test made by the Chicago City Railway Co. the connector withstood a strain of 3,000 pounds and soldered a test of 4,550 pounds. The splicers are furnished with slots cut in the sides for soldering if desired. The wood splicing tube has been on the market for over a year and has become a favorite wherever used.

An Electric Heater.

We illustrate herewith an electric car heater, the invention of Adam Cochrane of Lowell, Mass., and manufactured by the Reliable Manufacturing Co., of 53 State Street, Boston, Mass.



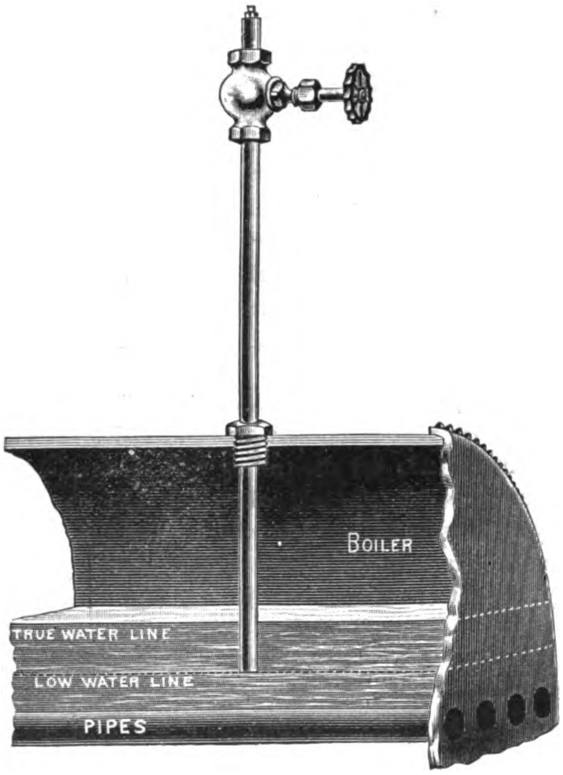
COCHRANE ELECTRIC HEATER.

The heater is designed to be placed beneath the seat of the car entirely out of the way. It is easily put in and does not disfigure the car.

The construction of the heater is shown in Fig. 1 in which "a" is a perforated tube of metal three and one-half feet long closed at each end by a hard rubber cap. Within this tube is a smaller tube one inch in diameter covered with asbestos upon which is a spiral of wire (d) connected with a wire leading from the trolley. This spiral, becoming heated by the passage of the current, warms the air within the outer tube causing a constant circulation of air through the perforations.

Signal Fusible Low Water Alarm.

In the accompanying cut is shown the Signal Fusible Low Water alarm attached to a sectional view of a boiler. This new device is being placed on the market by the Van Auken Steam Specialty Company, 203 S. Canal St., Chicago, who claim for it great simplicity and durability, and guarantee its positive action as it can at any time be tested. It has nothing to get out of order, being made without joints or floats. It goes on the boiler direct, and, it is claimed, will be found accurate under all conditions. It consists of a simple straightway valve, a brass plug and holder containing the fusible alloy which melts at 240 degrees. It is claimed for this device, on account of its simplicity and easy manipulation, that it can be attached with ease to portable boilers and is especially well adapted for stationery boilers in electric installations of all kinds.



SIGNAL FUSIBLE LOW WATER ALARM.

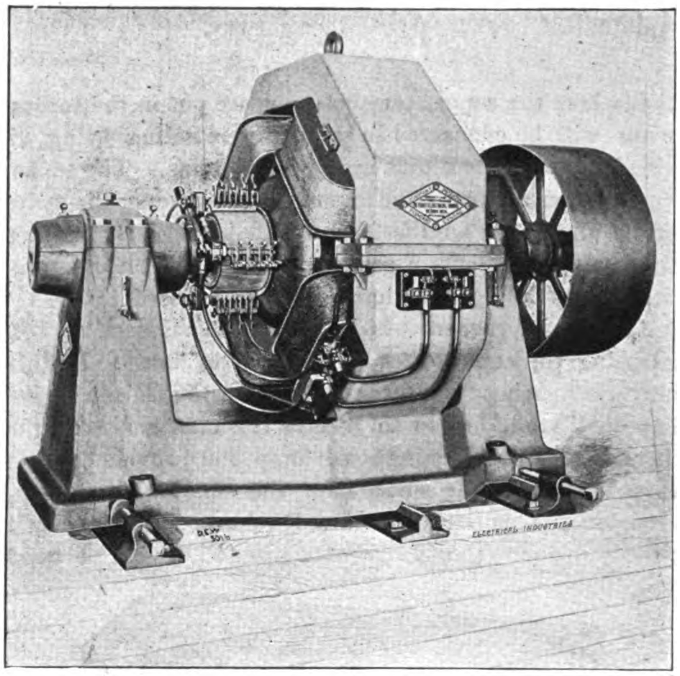
The manufacturers of this device are putting them on the market at a low price, owing to the large demand for a cheap and still reliable low water alarm. Each alarm is packed in a box with full instructions, ready for attaching, and is easily attached to the boiler by an ordinary mechanic.

It is reported that the persons back of the Chicago and Milwaukee Electric Railway are quietly perfecting their plans, and that the road will ultimately be built.

Detroit Electrical Works New Multipolar Generator.

The new type of multipolar street railway generators, manufactured by the Detroit Electrical Works, Detroit, Mich., and illustrated in the accompanying engraving, has found quick recognition of its merits. There has been a prejudice in the minds of some against the use of cast iron dynamos, this feeling probably being the result of the fact that in the early days of dynamo design cast iron was so uncertain and so little was known of its magnetic qualities. Today, however, the good qualities of cast iron are well known, and it is claimed it has many advantages over other metals for dynamo construction, among which is the fact that it is so readily adaptable to the form of iron clad machines whose superiority are everywhere recognized. It can be readily and quickly obtained of excellent quality, so that prompt shipments of completed machines are made easy, and besides the simplicity of design is another feature.

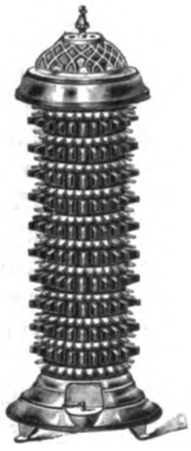
Realizing the good points of cast iron and confident that a line of machines could be made using only this material in the main castings of the dynamo, the Detroit Electrical Works brought out a year ago a full line of their bi-polar machines up to 45 kilowatt. These machines proved their excellence so thoroughly both in mechanical simplicity and practical operation, that the demand for them was surprising. So successful and satisfactory were the results obtained by this machine in the fact that there was no sparking under any variation of load that the company decided to follow out the same general idea in a line of multipolar machines of larger capacity.



DETROIT NEW MULTIPOLAR GENERATER.

The cut illustrates a 150 kilowatt machine having in general appearance the same characteristics as the other sizes. The armature is of the gramme type and is so wound that no wires having a difference of potential lie above or below one another on the exterior of the armature. The commutator is large and in order to avoid distortion of the field is made up of a large number of segments. Tests made by railway companies for the purpose of verifying the guarantees of the company have proven the efficiency of the machine to be 95 per cent. These generators are made in a number of sizes, namely, 100, 150, 200, 250 and 500 kilowatts. Of the first size eighteen are now in course of construction, ten of which go to the Calumet Electric Street Railway Company, Chicago, the remaining eight to various other street railway companies throughout the country. All these machines have slotted armatures with a new series service winding with which, however, four sets of brushes are used. It is said that there is no variation whatever of lead between no load and 10 per cent overload, the machines running exceptionally cool and in practice have shown their ability to stand an overload for several hours.

The features of these machines recommend themselves particularly. The first is that the rocker arm which supports the brush holder is mounted on the self aligning sleeve instead of on the outer shell of the bearings, as is usually the custom, the consequence of which is it is always held perfectly true with the commutator. The brush holders are of the standard Detroit type which are so well and favorably known. The second of the two features referred to is that all permanent connections, brush, cables and leads from switch boards are connected to the lower half of the main frame casting, and consequently the space directly over the machine is left clear, so that in the event of its being desired to remove the armature, it is only necessary to remove the bolts holding the two halves of the frame together and break the field circuit, when the upper half can be lifted off intact. This leaves all permanent connections undisturbed.



THE BURTON ELECTRIC HEATER.

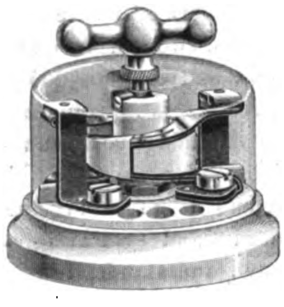


FIG. 1—GEN. ELEC. CO'S NEW SWITCH.

The Burton Electric Heater.

A very neat and efficient electric heater is illustrated in the accompanying cut. The stove is 36 inches high resting on a handsome nickle base with a nickle plated top. The surface of the various parts of the stove is broken into numerous small projections giving a very large radiating surface and consequently an increased amount of heat. The connections are made on the under side of the heater thus preserving the neat and uniform appearance of the heater. The stove is provided with a switch whereby two degrees of heat may be obtained, one for use in mild weather using from five to seven amperes of current and the other for cold weather using from 15 to 20 amperes of current. When the switch is in the latter position water may be boiled in a very few minutes, a flat surface beneath the nickle plated top being provided for that purpose.

These heaters are manufactured under the Burton Electric Company's patents and have been placed on the market by Taylor, Goodhue & Ames, Monadnock Block, Chicago, who report already a good demand for them.

General Electric Company's New Switches.

Two new switches have recently been brought out and placed on the market by the General Electric Company.

In Fig. 1 is shown a new double pole snap switch which differs it is claimed quite radically from all other snap switches. The characteristic and distinguishing feature is the ratchet piece which has four steps arranged in quadrants on both the upper and lower sides and revolve horizontally, two large and two small. One of these ratchet steps is covered with a copper strip passing across the porcelain to the corresponding step on the other side of the ratchet block. Two contact strips of hard spring copper placed opposite to each other top and bottom on either side bear upon the copper pieces on the ratchet when the circuit is completed. When the ratchet is revolved the copper spring pieces are slowly forced apart until the crest of the steps is reached when they spring on the uncovered steps or quadrants instantaneously, rendering arcing impossible, and placing between them a barrier of porcelain insulation. A similar forward movement makes the circuit instantly. The arrangement is similar to that in the ordinary plug switch in which a solid mass of metal is inserted between contacts and the circuit broken by its removal. In this switch the metal plug is withdrawn and instantly replaced by a porcelain plug. By the peculiar formation of the ratchet and the length of the copper brushes it has been found that the latter do not acquire a permanent set even after long use. This switch is made in the double pole variety only and is of the two patterns, the ordinary type and the flush pocket style. The latter is adapted to wall pockets. These switches are designed in capacities of 10, 25, 40 and 50 amperes.

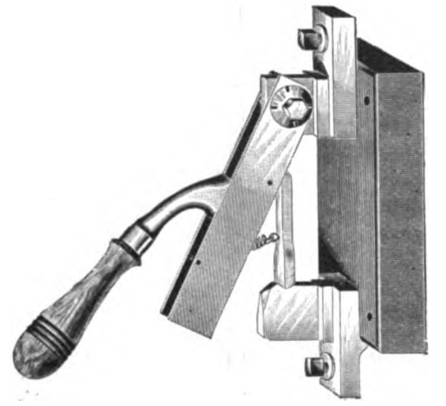
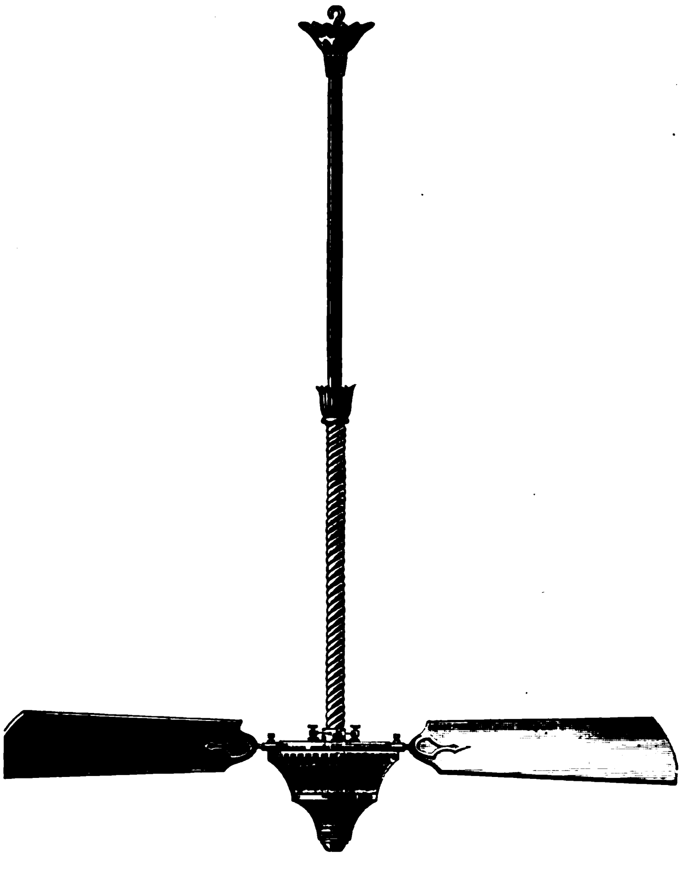


FIG. 2—GENERAL ELECTRIC CO'S NEW SWITCH.

Fig. 2 shows a feeder switch just put on the market by the same company, which is of an entirely novel design presenting a reversal of what has formerly been the accepted practice and in which the design has been to overcome the objectionable features found in other types. In this switch instead of a blade descending like a jackknife into receiving clips on a slate base the solid contacts are rigidly mounted on a base, and the clips, operated by the handle, come down one on each side of the contact piece. The switch is so designed as to have the contact surfaces true, this being effected in one operation upon a machine especially devised for the purpose. The soldering of the clips into the lugs is done away with, the lug and contact pieces being one homogeneous piece. The parallel clips are hinged to one contact piece and are also securely riveted to a piece of metal half way between the hinge and making end. To this piece is fastened a handle which projects upward and then forward at an angle of about 45 degrees. A new method of breaking the circuit has been introduced in this switch and no attempt has been made to bring the entire blade portion to a high velocity. The device, by means of which the circuit is thus suddenly broken, is a radical departure. It consists of a short brass bar fastened on the under side of the switch blades, one end pivoted near the middle of the blades, the other being held by a spiral spring, while on the side of the contact post facing the hinge of the switch is a small projection. As the switch is opened the end of the small bar catches on this projection and thus remains in full contact until after the blades have left the contact post. When the switch is well opened the bar slips over the contact post and is drawn by the spring to its original position, against the blades of the switch.



DIEHL ELECTRIC FAN.

The Diehl Electric Fans.

The accompanying illustration shows an electric fan manufactured by Diehl & Company, 385 Broadway, New York. This fan is especially neat in appearance, requiring no shafting or belts, the motor being concealed in the bottom of the drop, and the wires concealed as in an electrolier.

These fans are manufactured for floor and counter columns as well as for ceiling fans. The brass work is of an attractive design and highly finished, making the fan an ornament wherever placed. The fans are manufactured in numerous designs and styles, adapting them for the various places in which they are used.

The New Queen Measuring Apparatus.

In the accompanying illustrations are represented several new electrical instruments recently placed on the market by Queen & Company, Philadelphia.

Fig. 1 represents a new form of cylinder bridge. It consists of a revolving cylinder of polished hard rubber four inches in diameter and seven inches long, mounted on a frame. On this cylinder is cut a screw thread in which the wire is wound in 50 turns. In front of the cylinder, and running its entire length, is a wheel having its platinized surface turned true, so as to bear against the wire in a firm contact. As the cylinder is revolved, the wheel slides along the scale always in contact with the wire. This scale is divided into 50 parts, indicating complete turns. The wheel at the end of the cylinder is divided into 100 parts. Each part can easily be divided into tenths by the eye. Thus it is possible to read to one 5000th part of a wire or to the same part of an ohm. By means of two shunts placed inside of the cylinder, readings as low as two-1,000,000th of an ohm may be made.

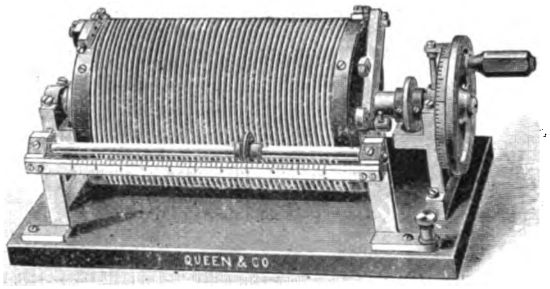


FIG. 1—QUEEN MEASURING APPARATUS.

In Fig. 2 is represented a new form of commutator used in comparing resistances and finding temperature coefficience by the Carey-Foster method. The instrument consists of an arrangement of thick copper connectors placed on an insulating base. The terminals for the unknown and standard resistances are so arranged that two coils in multiple can be placed on either side, a very useful feature in determining the resistance of a unit lengths of bridge wire. A very efficient and adjustable rheostat for laboratory purposes is shown in Fig. 3, in which the principle that the resistance of carbon is decreased by compression is used. A metal faced pressure block moving like a piston in each section and operated by a wheel above makes contact with the upper layer while a metal sheet binds against the lower. Each section has a carrying capacity of from zero to 25 amperes at an E. M. F. not over 5 volts. The terminals of each section are brought to a switch board by means of which the sections can be connected as desired.

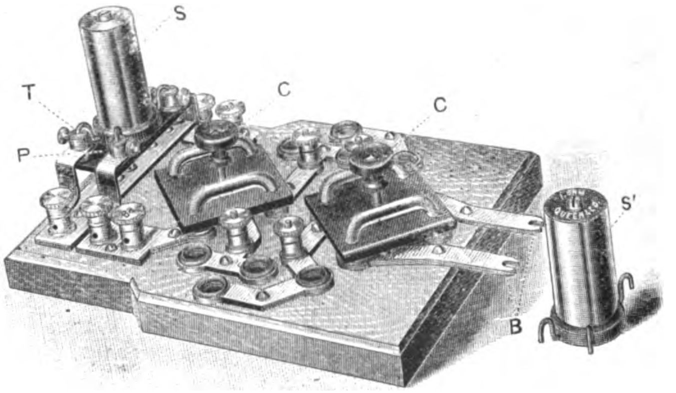


FIG. 2—QUEEN MEASURING APPARATUS.

New Self-Locking Windlass.

A new and novel arc lamp windlass is shown in the accompanying cuts, and to all appearances it embodies a number of very desirable features. The drum of the windlass is substantially made of malleable iron with a long and strong support for attachment to the pole, special care being taken to see that the holes for the lag screws are far enough above and below the drum to allow of their being driven and screwed home without having to remove the drum. The special feature of the windlass, however, is the way in which the crank answers the additional purpose of a key to lock and unlock the windlass.

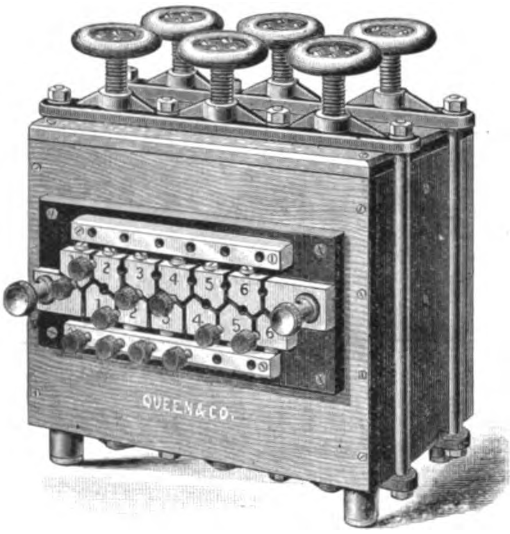
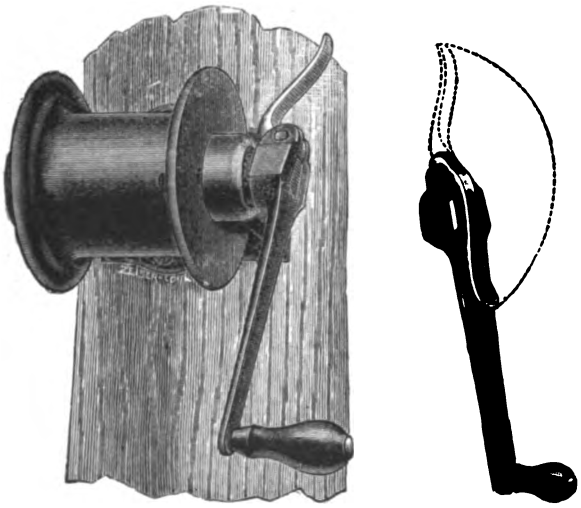


FIG. 3—QUEEN MEASURING APPARATUS.

Lying in a groove in the shaft of the drum is a strong lever pivoted near its center and having a powerful spring to hold it in the locked position. Inside the head of the drum, at the end opposite the crank, are six recesses in the casting, into anyone of which the lug on the end of the lever above mentioned is forced, thus allowing six positions in one revolution where the windlass can be locked.



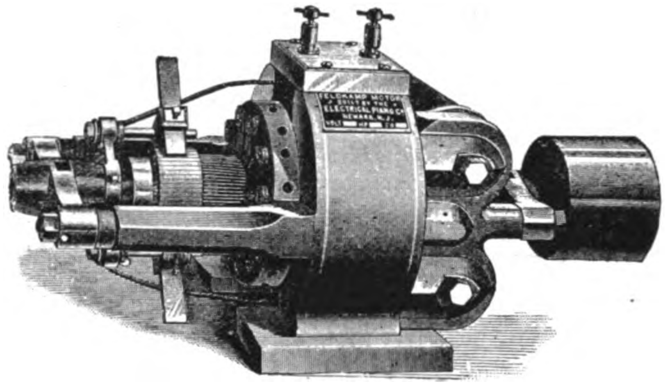
NEW SELF-LOCKING WINDLASS.

Placing the crank on the shaft has no effect on the locking mechanism, but after the crank has been set into place the lug can be released by forcing up the small tongue or lever as shown in the engraving. This forces a blade down on one end of the interior locking lever, withdrawing the cam, and leaving the windlass free to be raised or lowered at will. By simply pulling down the small tongue the windlass is again locked at any desired point. The lock is so made that it cannot be affected by rain or sleet, and a saving in time, it is claimed, is accomplished. The windlass cannot be left unlocked, and cannot be opened except with the special crank made for that purpose. The windlass consists of practically three extensions which are made sufficiently strong and heavy to guard against breakage, there being no small or intricate parts in the appliance.

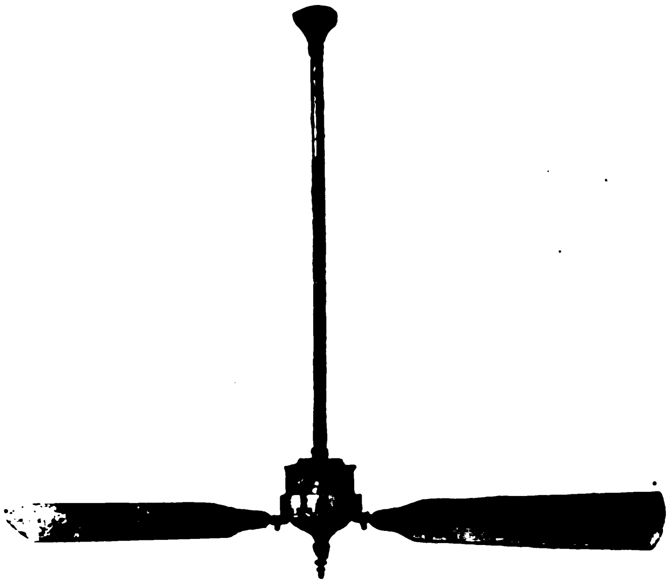
The Electric Appliance Company, of Chicago, has the general western agency for this specialty.

The Feldkamp Electric Motor.

In the accompanying illustration is shown a motor brought out by the Electric Piano and Motor Company, for which Mr. Wm. C. Callman, 591 Broadway, New York, is sole agent. As will be seen the field is created by two coils, the cores of which are bolted to side pieces on which the pole pieces are cast directly, making the magnetic field a short one. Cast directly on the frame, thus affording ample bearing surface for the shaft journals, are arms which carry the bracings for both the pulley and commutator ends. These motors are built in sizes ranging from one-fourth to 75-horse power.



FELDKAMP ELECTRIC MOTOR.



FELDKAMP ELECTRIC FAN.

We also illustrate a ceiling fan manufactured by the same company, designed for a 110-volt circuit. This fan is so constructed that it may be held stationary with a full current on without injury. This feature will be appreciated when one considers how frequently fans are stopped with the full current on and the trouble attending the repair should the motor be injured.

The New Storey Solenoid Motor for Direct Machine Driving.

This new motor has been produced as the result of the varied and extended experience of the inventor, Mr. I. E. Storey. Mr. Storey early recognized the necessity of properly protecting the motor, not only from the effects of rough handling but also the necessity of protecting the motor from the effects of dust and moisture which is so plentiful especially in machine shops and factories. His attention was first attracted to these requirements while in the mining regions of Colorado in 1880 and his first effort was the production of a motor for the direct driving of a mining drill in which not only the difficulties ordinarily met with were encountered but also a large amount of moisture and dust. This motor was entirely successful and this success led him to consider the general adaption of this principle to other lines of work. Following out this idea he has produced this solenoid motor which has been patented in the principal countries of the world. It is unique in form, of the highest mechanical excellence and is possessed of a maxium efficiency in proportion to the amount of material employed.

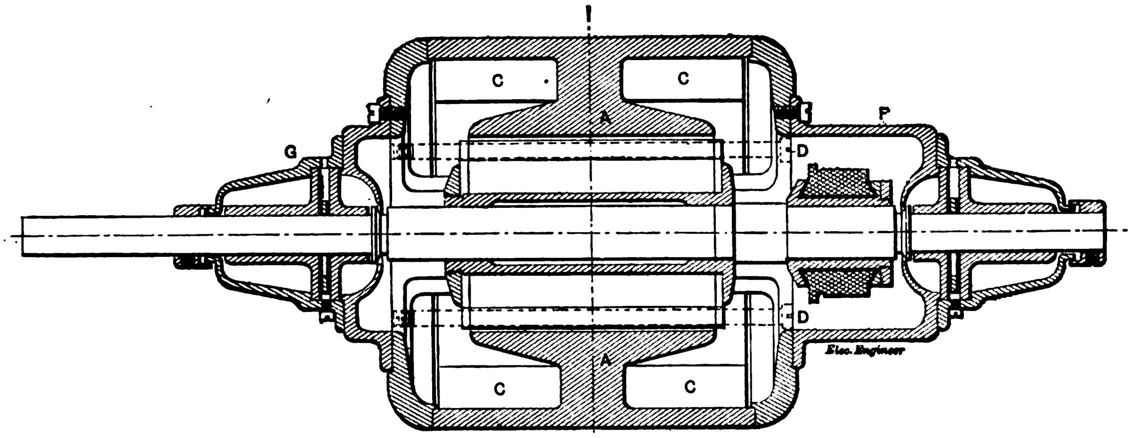


FIG. 1.—NEW STOREY SOLENOID MOTOR.

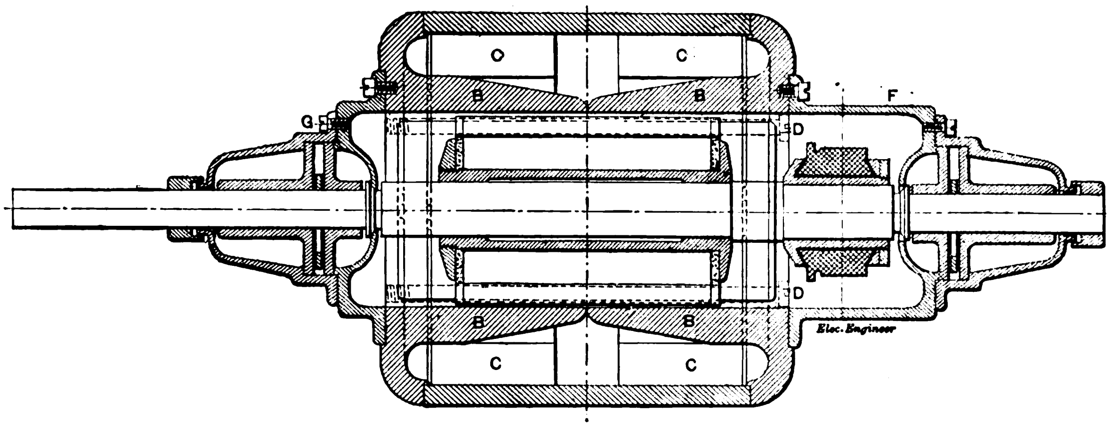


FIG. 2.—NEW STOREY SOLENOID MOTOR.

In the accompanying illustrations is shown the construction of the motor. It is cylindrical in form. Its self-oiling boxes permit it to be used in any position so long as its axis is horizontal. The field magnets are so arranged that while the center of the field is of one polarity the sides are of the opposite polarity. In Fig. 1 is shown a section through the T shaped pole pieces A projecting from the center of the cylindrical portion of the machine. Fig. 2 illustrates a section through the pole pieces B. projecting from the ends of the cylindrical portion of the machine. Thus it will be seen that, there are eight distinct magnetic circuits, although this is a four pole machine, making the paths of the magnetic lines uncommonly short and of low resistance, giving a maximum efficiency for the amount of wire used. The coils C are wound on spools of proper size, and when placed in position in the cylindrical chamber, after being properly insulated, are held in place by the pole pieces.

The armature is of the drum type, toothed. It is supported by the end caps F G which form the outside chambers for the self-oiling bearings, the ends of which are protected by a cap projecting over the opening of the box, rendering the box impervious to moisture or dust.

Thus the motor is protected from any outside injury, such as arises from rough handling or the presence of dust and moisture and also, being enclosed, no outside injury can arise from any internal condition such as the burning out of an armature or field. In combination with tools of various kinds, the motor has proven its fitness for the use for which it is intended. It is also well adapted to run lathes, planers, etc., as well as machines requiring a high and constant speed.

These motors, adapted to grinding or buffing, the operations of small tools and the transmission of small powers, are manufactured by the Hornell Iron Works, Hornellsville, N. Y. The Dahl Electric Company, 120 Liberty street, New York, are the manufacturers, agents for the eastern and middle states.

New Trolley Wire Insulator.

A new trolley wire insulator for straight line work has been brought out, and is being manufactured by the Creaghead Engineering Company of Cincinnati, O. This device is shown in the accompanying cuts.

The design and construction of the insulator is such as to give strength and at the same time lightness. The insulation shown in the engravings is moulded mica, but hard rubber insulation is furnished if desired. The insulator is moulded around a steel bolt three eighths of an inch in diameter at its upper end, and threaded to receive a clamp at the lower end. It is about the same shape as an ordinary glass insulator for supporting electric wire, and in consequence readily sheds water and offers a large insulating surface, both outside and inside of the petticoat.

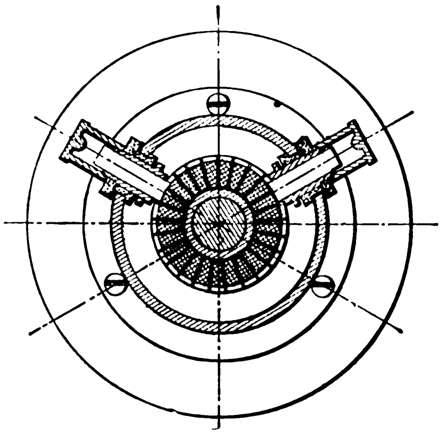


FIG. 3.—NEW STOREY SOLENOID MOTOR.

The insulator is attached to the span wire by means of a malleable iron yoke shown in Fig. 2. This yoke can be attached to or removed from the span wire at any point, without cutting the span wire. Every strain on the trolley wire only tends to increase the hold of the span wire and the yoke on the insulator.

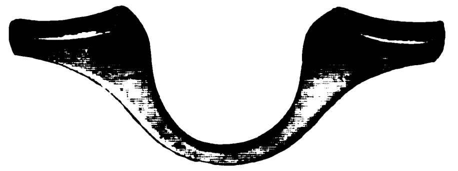


FIG. 2.

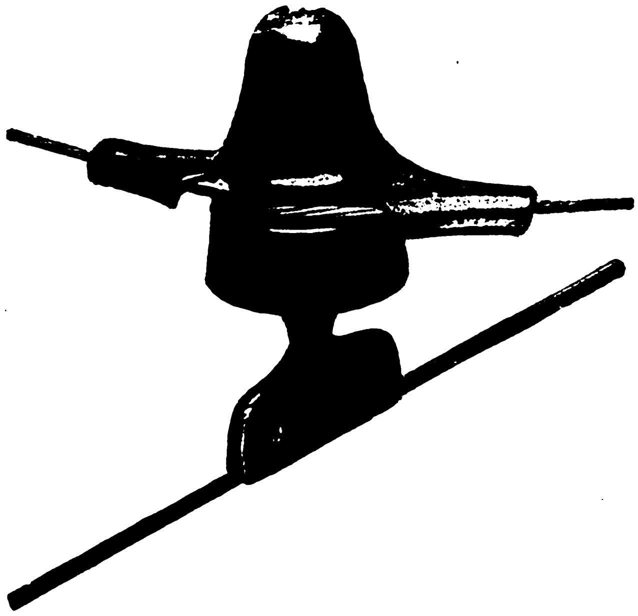


FIG. 1.—NEW TROLLEY WIRE INSULATOR.

Two styles of trolley clamps are manufactured, one having a hinge and one without. The clamps of both are screwed to the end of the steel bolt, extending from the center of the bottom of the insulator, and are easily attached. Other forms of clamps or soldered ears are also made and furnished.

The company reports highly satisfactory results from the use of the insulators on several complete equipments installed during the past year.

The Helios Alternating Current Arc Lamp.

The Helios arc lamp, which is controlled by the Helios Electric Company of Pennsylvania, 1310 Filbert street, Philadelphia, is the invention of Mr. Carl Cooper, of Ehrenfeld, Germany. The construction of the lamp is quite ingenious and the mechanism very simple. The accompanying cuts show the lamp as ready for use, and also with coverings removed showing the construction.

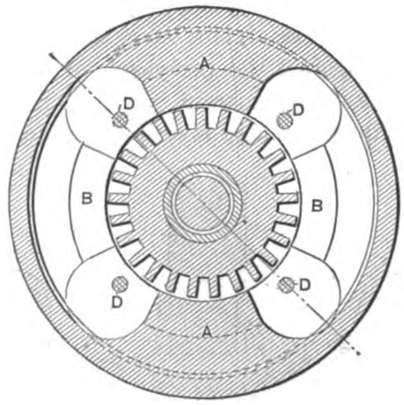
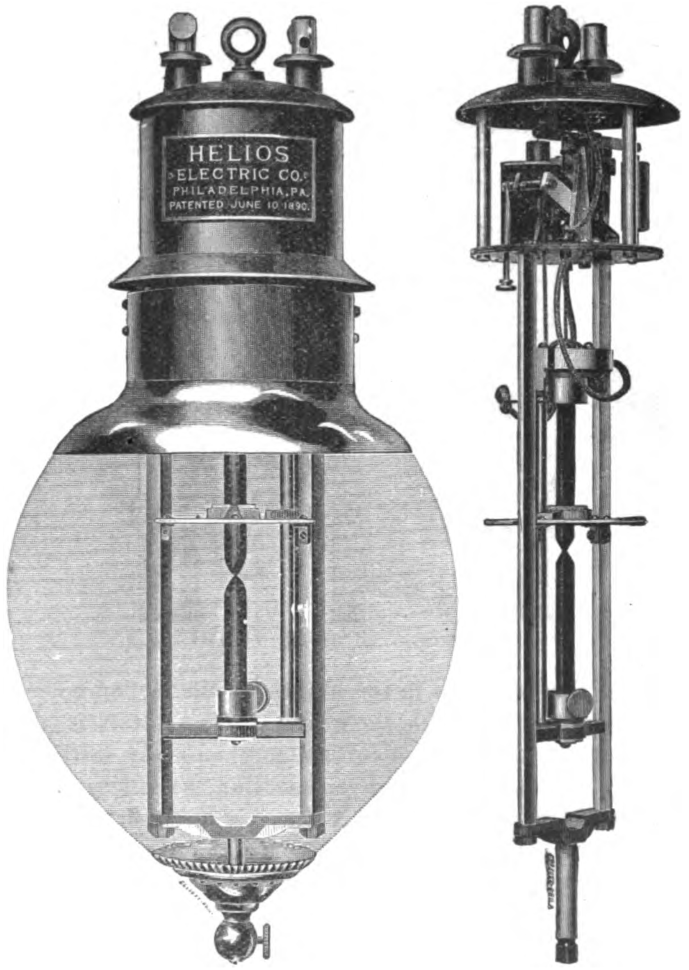


FIG. 4.—NEW STOREY SOLENOID MOTOR.



THE HELIOS ALTERNATING ARC LAMP.

The lower carbon, as will be seen in the illustrations, is attached to a chain, which is carried over a pulley in the lamp mechanism, the other end of the chain being attached to the upper carbon holder. Thus when the lower carbon ascends the upper carbon descends. The advantage of this will be readily seen in that, the arc always remains at the same point. Another very important and distinguishing feature of the lamp is the white enameled reflector placed about one half inch above the arc. As is well known, on an alternating current the light is thrown up as well as down, from the forming of a crater in the lower as well as the upper carbon. This reflector, placed as it is, throws down the light which would be otherwise thrown up and lost, thus increasing to a large extent, the usefulness of the lamp.

The regulation is effected entirely by a single solenoid coil. The feed of the carbon being controlled by a lever which presses against the periphery of a friction wheel included in the releasing train. By this means a feed of one-thousandth of an inch is made possible. There is a little difference made in the weight of the carbon holder, the upper being a trifle the heavier. The result is that the work of the solenoid coil and mechanism is restricted simply to the small weight representing the difference between the carbon holders. A free piston dash serves to steady the movement of the regulating mechanism.

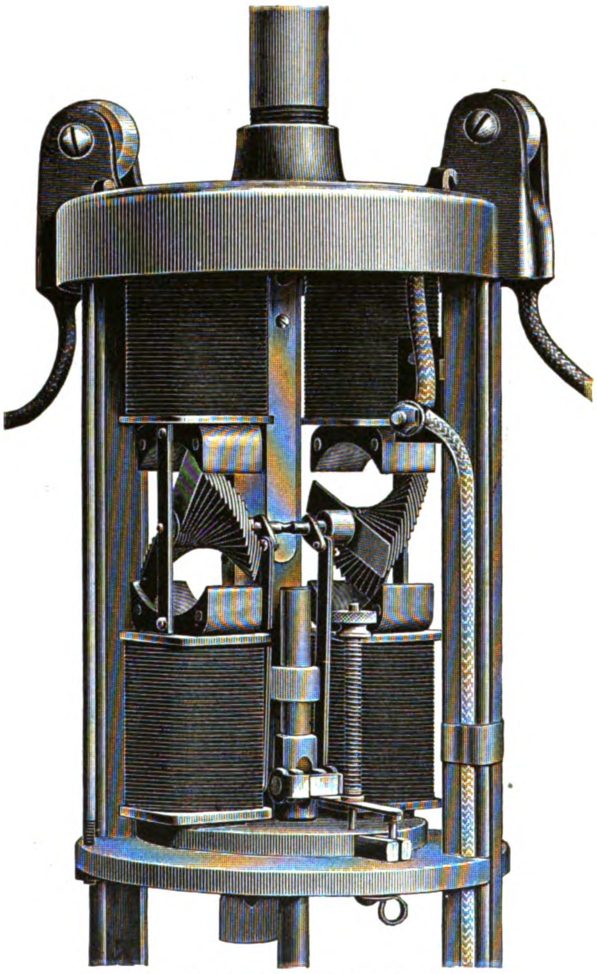


FIG. 1.—MOSHER ALTERNATING ARC LAMP.

The seven hour lamps are made 25 inches over all and the 12 hour lamp 32 inches. The single carbon principle is used exclusively. The lamp is adapted for a low tension, and is intended for use on either the 50-volt secondary circuit or with a special transformer a 30-volt circuit. Either one Helios lamp or two in series may be placed across the mains.

The excellence and the simplicity of the construction of this lamp together with the steady brilliancy and whiteness of the light commend it to users of the alternating current.

New Mosher Arc Lamps.

The Mosher Electric Company, 123–127 Ontario street, Chicago, manufactures several kinds of arc lamps. In Fig. 1 is illustrated the mechanism of its new alternating current lamp. As will be noticed in the cut the lamp is controlled by the rotary motion of the parts between the coils. Special attention has been given to the connections in this lamp. The connections are so constructed that it is impossible for them to get loose. The objectionable features, which are so apt to appear in the alternating arc lamp have been, it is claimed, entirely eliminated from this lamp. The lamp has been thoroughly tested and is considered as near perfect in its workings as it is possible to make it. The lamp is constructed for a current of 50 to 55 volts.

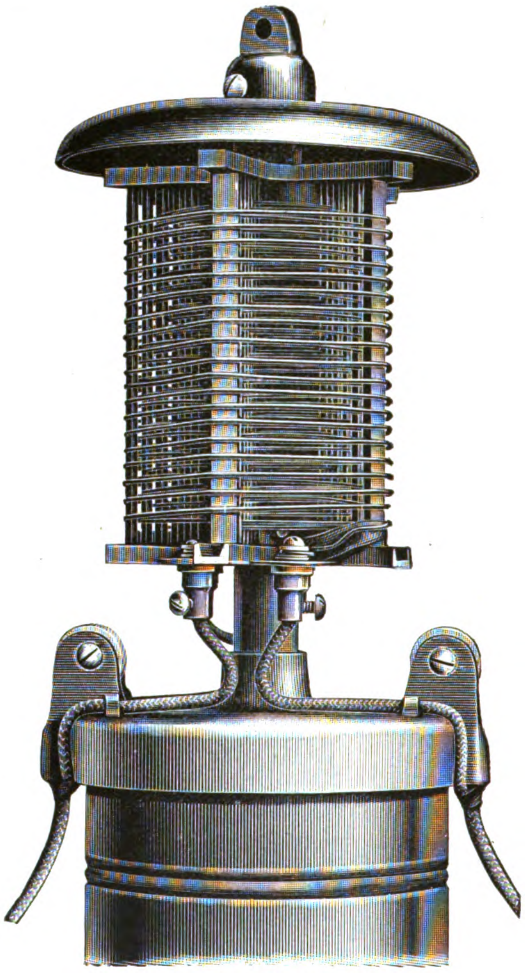


FIG. 2.—MOSHER RHEOSTAT.

The regular series arc lamp manufactured by this company is very much like, in outward appearance, the alternating lamp. It is furnished with either clutch or clock feed as may be desired. Fig. 2, illustrates the compound rheostat attached to the lamp. One winding of the rheostat is of a very low resistance and is always in circuit. The resistance of the other winding is equal to the resistance of the arc when burning and is automatically cut into circuit when for any reason the arc is broken. This insures the perfect working of the other lamps should one or more in the same series refuse to work.

Fig. 3 illustrates the mechanism of the railway circuit arc lamp. This lamp is constructed mainly for use on railway circuits and can be made to run from five to ten in series on a 500-volt circuit. These lamps are constructed with a rack feed and are wound to vary from six to ten amperes, according to the light desired. The feeding mechanism is controlled by separate magnets, one shunt and one main circuit, which releases the escapement and allows the lamp to feed only when the arc attempts to use more than its proportionate share of the voltage of the system on which the lamp is placed. The main circuit magnet is wound in such a relation to the desired circuit, that when the lamp is regulated for a certain number of amperes, that number will be practically maintained. It will be seen that this regulating magnet may be made as sensitive as desired. Its vibrations not effecting the arc, it is therefore, unnecessary to use a dash-pot.

This company also manufacturers a lamp for direct incandescent circuits.

New Panel Distribution Board.

Some method for controlling the distribution of the electric current in buildings, which could take the place of cumbersome cut-outs has long been a thing much desired by construction and wiring men. The use of what is known as the tree system and porcelain cut-outs have been in use for the past six years and little attention has been paid to the improvement of what may be considered an important matter.

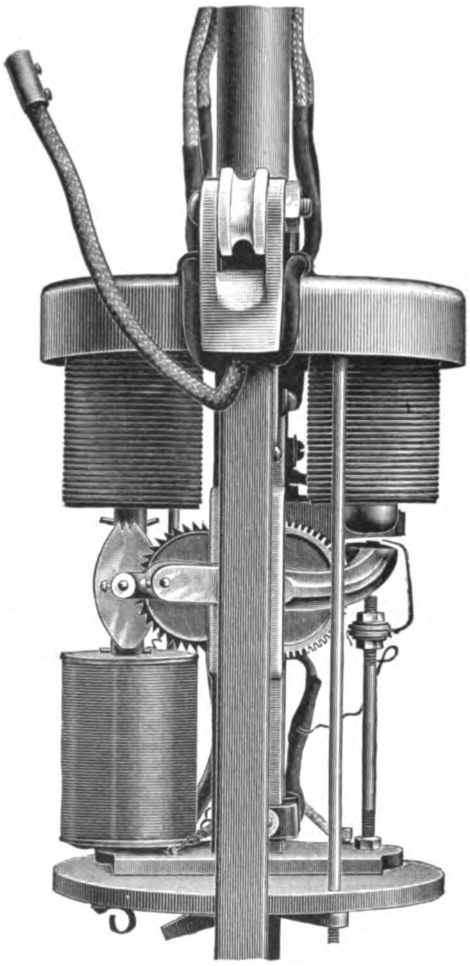
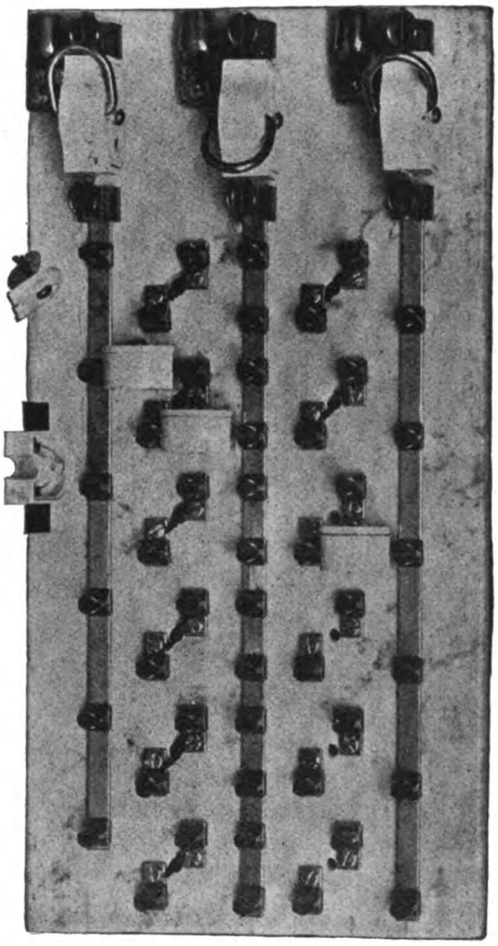


FIG. 3.—MOSHER SERIES ARC LAMP.



NEW PANEL DISTRIBUTION BOARD.

The General Electric Company, however, after giving the matter due attention, has just brought out and is putting on market a new system, which is shown in the accompanying cuts. This system is used as distribution centers for a number of circuits and at the same substitutes what is really a handsome device fulfilling all the functions of the devices heretofore used. The device is very simple in construction.

The cut shows one of these panel distribution boards, arranged for the distribution of current for 120 lights from a three wire main service over twelve circuits on a two wire system. The panel itself is a polished white marble slab, ten inches by twenty inches. The main wires are brought to the lugs, and are continued along the front of the panel in the shape of flat hard drawn copper rods. Upon these are mounted stiff spring copper clips. Each main wire and each side of each branch circuit is protected by a fuse enclosed in a porcelain box of novel design, from the side of which project short flat blades of copper. By means of these blades, the fuse carrier is inserted in position and is there securely held by the copper clips. A perfect friction at contact is thus insured.

The fuse carrier is peculiar in construction. It is literally a box with three sides straight and one arched, having a partition in the center between the two terminals to which the fuse is fastened as shown in the cut. No short circuit it is claimed, can occur between the terminals. The arc cannot follow the fused metal and burn them out. The molten metal cannot be blown out, the mica lined cover preventing this. The area of contact is greater than in the case of the screw fusible plug and in replacing a blown fuse the wireman is not exposed to danger from a sudden blow of the new fuse. A fuse carrier can be removed and the fuse replaced without difficulty or a fresh one can be inserted and that in which the fuse has blown can be carried away and the fuse replaced at the repair shop or the works. The removal of a fuse carrier with fuse of course disconnects the circuits. The porcelain carriers are practically indestructible as they are made from the best white vitreous porcelain.

The fuse carriers protecting the main wires are furnished with a small brass ring to facilitate their removal;

the smaller carriers being more easily drawn out the ring is unnecessary. All connections are made upon the face of the panel, this disposition enabling it to be fastened against a wall or sunk in a recess bringing its surface flush with the wall, a glass door hinged to a polished wooden frame, serving as protection.

This style of panel distribution board can be made up in almost any combination of circuits and can be placed almost anywhere in a building, as it is ornamental. The New Waldorf hotel is the first building to be fully equipped with these panels, no less than 3,500 lights being distributed from a number of them.

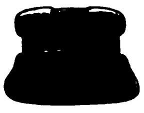


FIG. 1.

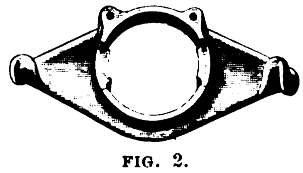


FIG. 2.

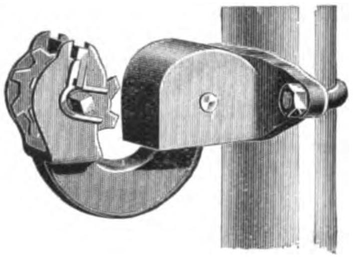


FIG. 9.

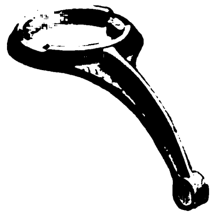


FIG. 3.

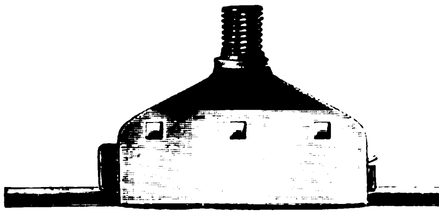


FIG. 5.

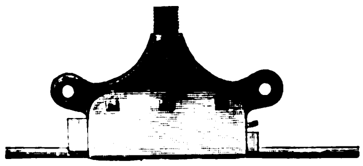


FIG. 7.

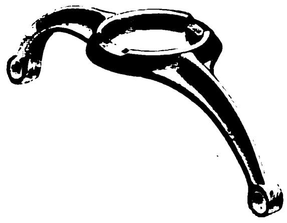


FIG. 4.

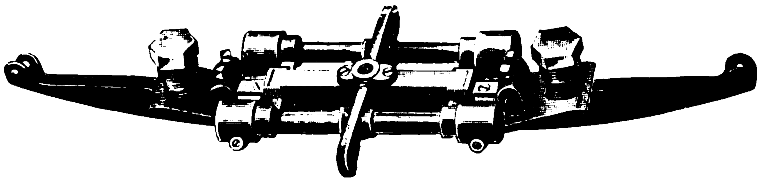


FIG. 8.

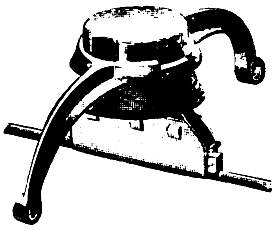


FIG. 6.

New Appliances for Trolley Line.

A number of new appliances for trolley line construction are illustrated in the accompanying cuts. These appliances, together with a new insulation called the "Medbery Insulation," which is now for the first time put on the market, are manufactured by the New York Electrical Works, 161 Washington street, New York.

The Medbery insulation is a hard and tough composition capable of being moulded into any form under great hydraulic pressure. Its insulating qualities are of the first order. It is furnished as a universal bell (Fig. 1), designed to fit into skeleton forms of all the different kinds of hangers, straight line, double and single pull offs, brackets, etc., several of which are shown in the accompanying cuts (Figs. 2, 3 and 4). Greater strength and permanence has been sought for in line of construction, by filling the insulation with five eighths inch bushings, to fit the five eighths inch bolts with which the clips and fittings are supplied. This will undoubtedly be looked upon as an improvement by all connected with trolley construction.

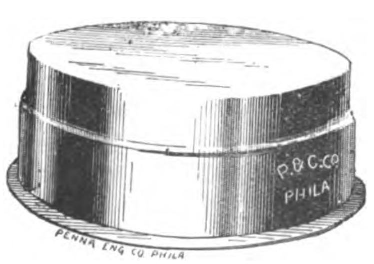


FIG. 1.—NEW POCKET BUZZER.

We illustrate also (Fig. 5) a new mechanical clip which presents a minimum resistance to trolley wheels of any pattern. It is quickly and easily applied or removed. It is made up of three parts: the body, which is furnished with a five eighths inch threaded bolt to which the Medbery insulation is attached, and with an incline lower surface to correspond to the surface of the wedge. The wedge is grooved on the lower side to fit the trolley wire, and has its smaller end cut so that, after it is inserted, the end may be pried apart, thus locking the clip securely to its place. The third part of the clip is the sheath, which is bent up in U shape and provided with holes which fit over lugs on the body of the clip. When the wedge i driven in, the edges of the holes in the sheath are drawn down into saw cuts in the lugs. This clip, combined with the universal bell and double pull off, is illustrated in Fig. 6. Fig. 7 is but a modification of the clip used as a strainer.

The section insulator manufactured by this company and illustrated in Fig. 8 has been used to a considerable extent with good results. The method of fastening the trolley wire employed in all the appliances of this company by means of rivets and clamps is much quicker than the use of solder, and it is claimed that the wire itself will break before these fastenings will give way.

In Fig. 9 is shown an insulated pole rachet in which the Medbery composition is used as an insulator. The insulating part of the rachet is covered, and thus protected from the weather. The rachet wheel shank is conveniently located, permitting the wrench to turn freely.

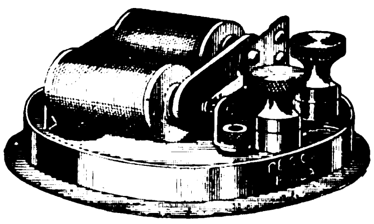


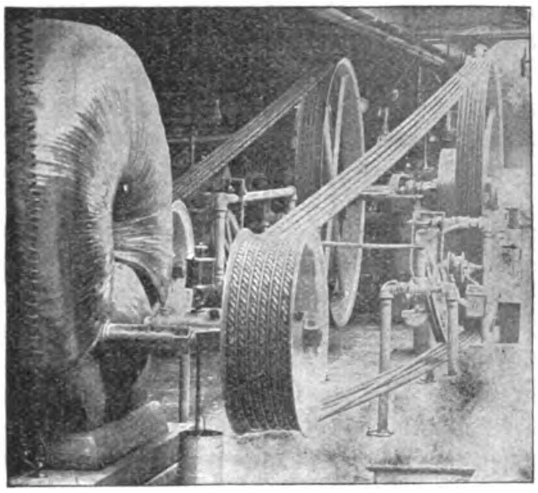
FIG. 2.—NEW POCKET BUZZER.

New Pocket Buzzer.

The Patrick Carter Co. of Philadelphia is manufacturing a new pocket buzzer. This buzzer is small but it gives a clear, loud sound. The accompanying cuts are full size. It is well adapted for many places where larger buzzers and bells are now used. It is durable and well made, being constructed entirely of metal.

Rope Transmission.

Rope transmission has been adopted with success in connection with several electric lighting plants established in this city. In the Chamber of commerce building the four, ring type Mather dynamos with a combined capacity of 240 kilowatts are connected by the system of rope transmission. This system is illustrated in the accompanying cut which also shows the sliding pulley by which the slack is easily taken up. This system is manufactured by the Link Belt Machinery Company, Chicago. It is used in the Rookery and also in both the Victoria and the Virginia hotels.

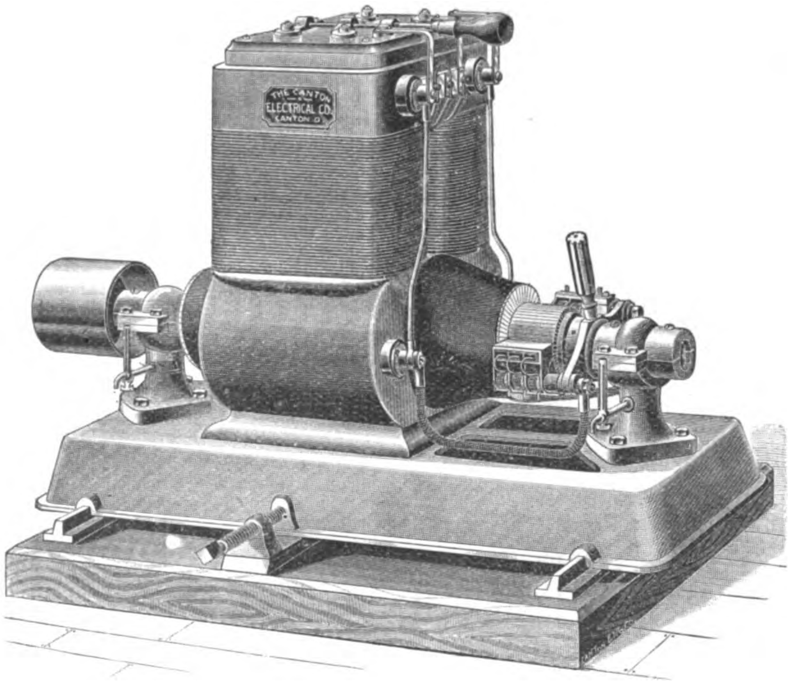


ROPE TRANSMISSION—CHAMBER OF COMMERCE BLDG.

The Canton Electrical Company's New Motor.

The motor illustrated in the accompanying cut is manufactured by the Canton Electrical Company of Canton, O.

This machine is well made, of simple construction, and particularly well adapted for all power purposes. It is compound wound and self-regulating. The switch to open the main circuit, as will be seen from the cut, is in the most convenient place possible, as is also the field and armature connection. The armature is wound to carry considerably more current than its nominal capacity. These machines are built throughout in the most substantial manner, and are wound for 110, 220 and 500 volts, carbon brushes being used exclusively. The output of the company includes motors from 1–12-horse power to 25 horse power, and they are constantly working up to those of 100-horse power.

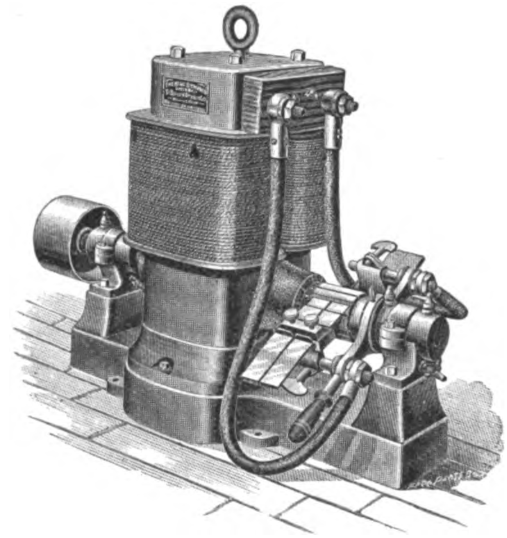

THE CANTON ELECTRICAL CO. CANTON O.

NEW CANTON ELECTRIC MOTOR.

The company also builds dynamos on the same general lines, as the motor for 110 volts, from 300 to 1,200 lights capacity. Carbon brushes are used on the smaller machines, and copper on the larger.

Improved Plating Dynamo.

The Detroit Dynamo Company, Detroit, Mich., is now putting on the market a new and improved design of its well known "King" dynamo for arc and incandescent lighting, electroplating, electrotyping, and copper refining. This new machine has self oiling bearings and a zinc sub-base between the pole pieces and the iron base. The commutator is screwed on so that when there is need of a change another one can be substituted without removing the armature. As will be seen from the illustration this dynamo does not differ materially in design from the well known type of this make.



IMPROVED PLATING DYNAMO.

The Incandescent Lamp from a Commercial Standpoint.*

All modern commercial forms of electric incandescent lamps in this country are similar in that each produces light by heating to incandescence a hard carbon burner of comparatively high resistance, enclosed in a glass receiver from which the oxygen has been largely exhausted. We know that after a time a burner so heated gradually depreciates, either by disintegration, oxidation, or some other cause, and is finally destroyed. We know that of two similar burners that raised to the higher temperature will require less energy per unit of light produced, but that its depreciation will also be more rapid and its destruction take place sooner. Consequently, in determining the temperature at which a carbon should be burned to secure the best economy, we are influenced to use a high temperature on account of the first condition, and a low temperature on account of the second condition.

There may be said to be other causes, due to differences in the design and construction of various lamps, which will affect the length of the lives of their burners, but it seems fair to assume that by the employment of proper methods, these causes may be eliminated in so far as they hasten depreciation in one carbon more than in another, and, therefore, in discussing the relation between the life and efficiency of different lamps, we may consider simply the characteristics of their burners.

For convenience in discussion, we may divide the commercial lamp burners into three classes, viz.:

1st. The untreated or natural burners used in the Edison lamps.

2d. The treated or flashed burners used in the Sawyer-Man, Thomson-Houston, Beacon, and a number of other lamps.

3d. What we may call the super-treated burners used in the new Westinghouse stopper lamps.

In all published tests of the life of burners there is shown to be a definite relation existing between the life of a carbon on the temperature at which it is burned, this relation remaining fixed for carbons of the same kind and varying only for carbons of different kinds. If we formulate this relation, it will assist us to determine what temperature of any kind of carbon may be expected to yield the best commercial results; that is to say, how much money it is desirable to spend on the maintenance of the carbon, and how much on the energy to heat it.

From a series of experiments on the Sawyer-Man carbons, Frank Stuart Smith has found the relation between their life and efficiency. This relation is confirmed by many other tests and from a number of experiments on other lamps having treated carbons, we find that the relation of the lives and efficiencies follows the same general law that the greater the efficiency of the light the shorter the life of the lamp and vice versa. From tests made by Mr. Smith during the past year on the super-treated carbons of the new Westinghouse stopper lamp, we find the relation between the lives and efficiency of the lamps corresponds very closely to that of the treated carbons of the Sawyer-Man lamps, except for a given efficiency, the life is always longer. From a paper of John W. Howells, containing the results of a large number of tests of the Edison or untreated carbons I find that the relation of the lives and efficiencies of these carbons is very similar to those of the treated and super-treated carbons, except that for a given efficiency the life of the carbon is always shorter.

If I take for a unit of value one 16-candle lamp hour, assuming that what the public want is light, and that other things being equal it does not care whether much or little energy is expended to produce it, therefore whenever we can increase the efficiency of our lamp, we not only reduce the cost of the energy required to burn it, but also increase the capacity of our station, lines, converters, etc., by a proportional amount. Owing to the fact that the various meters in use measure, not light, but energy in one form or another, when we make our unit the lamp hour and afterwards increase the efficiency of the lamp we must also increase our charge for unit of energy in order to maintain the same standard of price.

It is very interesting to note that in every case the profits fall off very rapidly for lamps of either too high or too low efficiency. The variation being more marked when current is dear and running expenses high. By putting these facts together, it is apparently clear that the long lived inefficient lamp is an expensive article and that too much weight has been given to the cost of lamp renewals, which shows prominently on the expense side of the ledger, while we have not paid enough attention to the great waste of energy due to low lamp efficiency. We note that the most economical conditions call for, in the case of untreated filaments, a life of between 250 and 525 hours in the case of a treated, a life of between 285 and 620 hours, and in the case of the super-treated filaments a life of between 136 and 260 hours; the shorter life being in each case where both the cost and selling price of the lamp hour is high.

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*Abstract of paper read by Colvert Townley before the Mational Electric Light Association, St. Louis, Mo.

PERSONAL.

Mr. M. B. Austin, of the Knapp Electrical Works, has recently recovered from quite a severe illness.

Mr. Henry L. Walker, secretary and treasurer of the Detroit Dynamo Company, was in Chicago a few days last month.

Mr. W. H. McKinlock of Chicago accompanied by Mrs. McKinlock and Mrs. M. J. Green visited New York during the pas month.

TRADE PUBLICATIONS.

We are in receipt of a catalogue issued by the Cutter Electric & Mf'g. Company, Philadelphia, illustrating and describing the C-S specialties. It is nicely printed and altogether attractive.

The Dick and Church engines are finely illustrated in a neat and comprehensive catalogue, issued by the Phoenix iron works. The description of the engines is thorough and complete and is accompanied by reports of tests of the engines.

The General Electric Launch Company has issued an attractive circular, containing prices and other information regarding electric launches.

A very complete, finely printed, and fully illustrated catalogue is just at hand from the Electrical Engineering & Supply Company, St. Paul, Minn. This company carries a full line of well known specialties, including National incandescent dynamos and transformers, Standard arc lighting apparatus, power generators and motors Packard lamps, Paranite wires and cables, Grimshaw wires, "O K." weatherproof line wire, Syracuse sockets, cut-outs and switches, etc. This catalogue gives a full list of these and many more specialties, together with complete price list. Everything from push buttons to complete equipments for electric light plants are handled by this company. The catalogue is one of much interest, containing valuable tables, wiring rules, etc., and a copy should be in the hands of every station manager for convenience of reference.

Convention Notes.

THE WESTERN ELECTRIC COMPANY, Chicago, had its interests well taken care of by Mr. E. W. Goldsmith.

THE MUNSON BELTING COMPANY, Chicago, was represented by J. H. Shay.

THE JENNEY ELECTRIC MOTOR COMPANY, Indianapolis, Ind., was well represented by its chief promoter, Mr. C. B. Jenney.

WILSON & JACKSON, Chicago, a new firm in the contracting business, was represented by Mr. C. H. Wilson, long and well known in the telephone business.

THE CONSOLIDATED ELECTRIC MANUFACTURING COMPANY, Boston, had its interests taken care of by Mr. C. E. Bibber, who had with him a print showing his new arc light dynamo

THE STANLEY MANUFACTURING COMPANY, Pittsfield, Mass., although it made no exhibit was well represented by its president, Mr. C. E. Atwater and general manager Mr. Henry Hine.

THE MATHER ELECTRIC COMPANY, Boston, was represented by Mr. Chas. I. Hills who presented the delegates and others with a very ingenous pocket screw driver, a thing much appreciated by every one fortunate enough to receive one. It was one of the best souvenirs of the convention.

THE E. G. BERNARD COMPANY, Troy, N. Y., had in attendance Mr. Bernard who showed several of the Powers arc light cut-outs in which central station men were greatly interested. Mr. Bernard has already in use a large number of these most excellent devices and arc circuits.

THE CIRCULAR LOOM COMPANY, Boston, Mass., was well represented by Mr. H. H. Brooks, who interested central station men generally in the merits of his wire.

THE INDIANA RUBBER & INSULATED WIRE COMPANY, Jonesboro, Ind., had in attendance its general manager, Mr. C. J. Butler, who made many friends at the convention. Mr. Butler's office will hereafter be at Marion, Ind., a short distance from the works. This arrangement will, Mr. Butler thinks, greatly facilitate his business matters.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, made an interesting exhibit of a new alternating current motor at its office. The motor was two-horse power operating a direct current generator. This motor excited a great deal of interest and comment, although Mr. Herbert A. Wagner, the designer and builder, took no pains to advertise the fact of its successful operation to any one present.

THE WASHBURN & MOEN MANUFACTURING COMPANY, Worcester, Mass., had its interests well taken care of by Mr. Edward Stockwell of the Chicago office of the company. Mr. Stockwell had with him a few samples of the Salamander wire, some of which had been through the fire thus telling their own story. This wire has had some remarkable tests and it is claimed for it that the conductor can be brought to the melting point before destroying the insulation.

THE CHAS. E. GREGORY COMPANY, Chicago, was represented by Mr. Gregory himself. Mr. Gregory has recently organized his present company whose business will include the repair of second hand electric machines, in connection with the other business of selling and trading second-hand machinery. His company will also manufacture some specialties. At the convention Mr. Gregory had with him some of his specialties which attracted much attention, among them being the Pfluger arc switch.

THE ELECTRIC SELECTOR & SIGNAL COMPANY, New York, was represented by its general manager, Mr. C. B. MacKie, Mr. Robb MacKie and Mr. H. Laws Webb, who had on exhibition in full working order this valuable piece of apparatus. During the past year this apparatus has been greatly improved in many details and at present the company feels that it is as near perfection as it can well be. The central station men present were very much interested in its working.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., were ably represented by Mr. P. C. Ackerman, their New York manager who was on hand to take any orders that might come along though he did not make a general exhibit of his well known wires and cables. While in St. Louis he secured an order from the Union Depot Railroad Company for some thirty miles of 0000 weather proof wire.

JAS. J. MURRAY & COMPANY were represented at the convention by Mr. J. K. Martin who showed a very fine line of samples of globes for both incandescent and arc lighting. Among the many styles for incandescent were the clear, opal, rough, etched, opalescent, rose opalescent and ruby. The line of colored globes which they exhibited is an entirely new departure with this firm this season. Among the novelties in this line is a green plated shade made by them exclusively in this country. A recent demand has been created for etched and cut arc globes for interior work and this firm have special facilities for turning out the very finest work in this line.

THE JEWEL BELTING COMPANY, Hartford, Conn., was well represented by Messrs. C. E. Newton and Wm. Wheelock through whom it presented a very handsome and valuable souvenir to the members of the association and others. This souvenir consisted of a pocket book of just the right size to carry bills of all denominations. In each pocket book was found a very unique advertisement which looked considerably like a hundred dollar bill. The demand for this memento was very great.

THE NORWICH INSULATED WIRE COMPANY, New York, was represented by its treasurer, Mr. Geo. J. Jackson.

H. M. LOUD & SONS LUMBER COMPANY, Au Sable, Mich., was represented by Mr. G. H. Keating of Bay City. This company does a large business in poles, cross arms, etc., for electric light and railway service.

THE ELECTRIC CONSTRUCTION & SUPPLY COMPANY, manufacturers of the well known Ward arc lamp were ably represented by Mr R. B. Corey its general manager.

THE PHILLIPS INSULATED WIRE COMPANY, Pawtucket, R. I. had its interests carefully looked after by Mr. H. C. Adams of New York. The wire made by this company is called the "O. K.' brand.

THE ENTERPRISE ELECTRIC COMPANY, Chicago, was well represented by its president, Mr. W. C. McKinlock and Mr. W. H. Ferris the manager of the St. Louis branch of the company. These gentlemen made many acquaintances among the delegates present and also kept an eye to business in the matter of presenting the merits of the N. I. R. wire when occasion presented itself.

THE CHICAGO and ST. L. ELECTRIC RAILWAY had in attendance Dr. Wellington Adams its general manager, Prof. Nipher, Messrs. Geo. F. Steedman of St. Louis and E. F. Seixas of Chicago. Thursday evening Dr. Adams with Prof. Nipher and Mr. Steedman gave a dinner party to some of the delegates present.

THE ELECTRIC APPLIANCE COMPANY, Chicago, was represented by its secretary and treasurer, Mr. Thos. I. Stacey, and its special agent, Mr. A. L. Millard, who were assisted by Mr. C. J. Butler, manager of the Indiana Rubber & Insulated Wire Company, for which the company are agents. The company made a neat display in the gentlemen's parlor of a line of Whitney instruments, swinging ball lightning arresters, Packard lamps, acme expanding wire guards and attractive samples of Paranite wires, cables, and switch cords; also nicely arranged sample case of "O. K." weather-proof wire. They resorted to some of the most original and novel advertising schemes presented at the convention. Among other things, they distributed numerous circulars of their specialties and a small pamphlet entitled "What Others Think," in addition to which their friends were kept supplied with first-class cigars bearing the "Paranite" label. The company also supplied the guests of the Southern Hotel, and at the Friday banquet with celluloid toothpicks bearing the company's name nicely printed, and as they were of assorted colors the effect was very neat.

THE C. & C. ELECTRIC MOTOR COMPANY, New York, made an exhibit, in connection with the Electric Selector & Signal Company in parlor 54, which consisted of a 7½-horse power motor attached to a dynamo which in turn was connected to the Selector company's apparatus. General manager Hall of New York was present together with Messrs. C. E. Wilson of Chicago and E. B. Matlack of St. Louis.

MR. C. O. BAKER, JR., master of transportation of the National Electric Light Association was treated to a most agreeable surprise on the afternoon of Wednesday by the New York delegation under whose care it came to the convention. It was the opinion of all that Mr. Baker was deserving of some token of appreciation for the services rendered and they quietly purchased for him an elegant silver punch bowl and ladle. Mr. T. C. Martin made the presentation speech. Mr. Baker, although taken very much by surprise, responded in a few well chosen words.

The Cutter Electrical Manufacturing Company, Philadelphia was represented by Mr. Cutter himself, who had on exhibition in his parlor some switches. These switches were arranged on sample switch boards in a very neat manner, among the number being the C. S. flush double push switch, double pole, single pole and three wire; also the flush double push commutation switch for three and four wires. The exhibit attracted much attention.

The Fort Wayne Electric Company had on exhibition its new Wood alternating and constant potential arc lamp. The special feature of this lamp is its simplicity of construction, there being but one point of adjustment in its mechanism. Mr. Wood, the inventor, was himself present to explain the construction and working of the lamp to the delegates. The company also had on exhibition a double alternating arc lamp which it is claimed is the first of the kind shown in this country.

The Weston Electrical Instrument Company of Newark, N. J., was represented by Messrs. Edw. Weston and R. C. Heinrichs, who distributed handsome circulars descriptive of the new Weston ammeter, voltmeters, and other instruments including the various parts. This exhibit attracted much attention.

Mr. S. E. Whitehead, of Carthage, Mo., exhibited the Eddy patent self-locking windlass for raising and lowering arc lamps.

The Garton-Daniels Electric Company, Keokuk, Ia., was represented by Mr. Garton. The lightning arrester, which is one of the specialties of this company, was put on the circuit of the Union Depot Railway during the week and the test made it show its efficiency in the case of a short circuit on a line carrying from 1,000 to 1,500 amperes. The test was very satisfactory to all who saw it.

The Interior Conduit Company, New York, had its interests taken care of by Messrs. E. W. Little and Romaine Mace, who exhibited the Lundel' motor and some of the interior conduit specialties made by the company.

The Okonite Company, as usual, was ably represented in the person of Mr. Geo. T. Manson who had with him some samples of the well known Okonite wire. Mr. Manson is always one of the most welcome and popular men at these conventions.

The Mosher Electric Company, manufacturers of the Mosher arc lamp, was well represented by Mr. G. L. Reiman its president, and Mr. J. A. Mosher vice-president, who explained that the new Mosher lamp is just the thing for alternating current service.

The Standard Electric Conpany, Chicago, had its interests well cared for by Mr. D. P. Perry its general manager, and Mr. F. E. Drake, general salesman of the company. The merits of the Standard dynamo were fully explained by these two gentlemen.

The Eureka Tempered Copper Company, North East, Pa., was represented by Jno. R. Coffman of Detroit. Mr. Coffman exhibited segments for railway generators and motors as well as brushes for arc and incandescent work besides a full line of sheet copper of all gauges generally used for electrical purposes.

The Electric Engineering & Supply Company, Syracuse, N. Y., made an exhibit of some of its specialties, having Mr. Goercke in charge. Among these specialties were a handsome concealed terminal central station switch and a flush switch for a conduit wiring system, a porcelain covered branch block, a few samples of the E. E. & S. sockets, and a new fusible combination wall socket. A complete line of incandescent snap switches were also among the exhibits.

The Boston Incandescent Lamp Company, Boston, Mass., had a nice exhibit in charge of Mr. Matt Merritt of its new series lamp for use on arc circuits. The lamp attracted much attention, and its importance in this field of work is well recognized.

The Card Electric Motor & Dynamo Company, Cincinnati, O., was ably represented by its president, Mr. J. W. Wiltshire, who attended the convention for a couple of days and made many acquaintances among central station men. This company is splendidly equipped to handle its large motor business, but will be especially so as soon as it gets into its new factory now under construction.

The Laclede Carbon & Electric Company, Peru, Ind., was represented by Mr. P. C. Burns.

The Phoenix Glass Company of New York was well represented by Mr. Ned Fox who arrived just at the close.

The Heisler Electric Company, Philadelphia, had its interests well taken care of by Mr. Walter F. Smith and Mr. W. S. Horry.

The Eddy Electric Motor Company, Windsor, Conn., was ably represented at the convention by Mr. A. D. Newton, secretary and treasurer, Mr. M. E. Baird, general agent, and Messrs. G. A. E. and Frank Kohler, managers of the Chicago branch of the company. The exhibit made by these gentlemen attracted a great amount of attention and consisted of a 15-horse power and a one-horse power motor of an entirely new design. The larger motor ran at a very low speed, the special feature being its large and well ventilated armature. The motor is very compactly built and has ingenious features that make it very efficient. The motor drove a dynamo which was connected to two Ward arc lamps, making altogether a very attractive exhibit.

The General Incandescent Arc Light Company, New York, had a very attractive exhibit of arc lamps in charge of Mr. A. G. Noll. The designs were very handsome and unique. Several of the lamps were burning on incandescent circuits, and central station men were much interested and pleased with them.

The Bryant Electric Company, Bridgeport, Conn., had its interests well taken care of by Mr. Thos. G. Grier of the Chicago branch, who exhibited a handsome line of Bryant switches. The company presented delegates and friends with a substantial souvenir in the shape of a pocket book containing its advertisement.

The New York Insulated Wire Company, presented through its general manager, Mr. J. W. Godfrey, a very neat and useful note book bearing the advertisement of the company. In the frontispiece of this little book was a handsome portrait of Mr. Godfrey.

The H. W. Johns Manufacturing Company, Hartford, Conn., was ably represented by its general manager, Mr. E. B. Hatch, who was on hand to shake hands with his many friends at the convention. This company makes a specialty of moulded mica for electric work, and Mr. Hatch received a number of orders while in St. Louis.

The Massachusetts Chemical Company, Boston, had its interests well taken care of by Mr. Harry Bishop, the general western agent of the company, who has his headquarters in Chicago. Mr. Bishop received several orders for insullac during the convention.

The Tice-Lintner Electric Company, Minneapolis, Minn., had in attendance its Mr. E. S. Tice, who improved the opportunity of making many acquaintances.

The Westinghouse Electric & Manufacturing Company, distributed a handsome circular of the Sawyer-Man stopper lamp, which fully sets forth the merits of this new comer into the lamp field. The company had its interests well looked after by Messrs. E. H. Heinrichs, L. B. Stillwell of the Pittsburgh office, and Manager Pantaleoni of the St. Louis office.

The Goodrich Hard Rubber Company, Akron, O., had its interests well taken care of by Mr. J. C. Pierrez, who made the acquaintance of every one in attendance in any way interested in rubber goods.

The Helios Electric Company, Philadelphia, was well represented by Mr. D. C. Spruance, who called particular attention to the new lamp which is being put on the market by his company. Mr. Spruance showed the lamp in use in various places, and central station men were pleased with its simplicity and steady light.

The Diehl Motor Company distributed circulars descriptive of its goods.

Mr. H. T. Paiste, Philadelphia, was on hand renewing old acquaintances.

The Falls Rivet & Machine Company, Cuyahoga Falls, O., was represented by its president, Mr. E. L. Babcock, and son, who presented the merits of their well known friction clutches, which are used by many of the largest electric light and railway companies in the country.

The New York & Ohio Company, Warren, O., was ably represented by Mr. W. D. Packard, who was on hand renewing old acquaintances and making many new ones. The merits of the Packard lamp are too well known to need comment.

The General Electric Company made no exhibit, but was represented by Dr. Louis Bell, Mr. B. E. Sunny, and Mr. J. J. Moore.

John A. Roeblings Sons Company, Trenton, N. J., had on hand to look after its interests Mr. Geo. C. Bailey, manager of the Chicago office, and Mr. A. B. Conover, general western sales agent.

TAYLOR, GOODHUE & AMES was represented by Mr. Wells Goodhue, who had with him a very handsome model of the Diamond transformer which has been put on the market by this firm and is already meeting with a large sale throughout the country.

THE CENTRAL ELECTRIC COMPANY, Chicago, had its interests well taken care of by Mr. W. H. McKinlock, the president of the company, and Mr. C. E. Brown. Mr. McKinlock found a great many of his present customers at the convention, with whom he passed a pleasant time shaking hands.

CUSHING & MORSE the Chicago agents of Kerite wires and cables had their interests actively taken care of by Mr. F. S. B. Morse, of the firm. Mr. Morse made many pleasant acquaintances.

THE PARTRICK & CARTER COMPANY, of Philadelphia, which is one of the pioneer electrical concerns of the country had its interests well looked after by E. Ward Wilkins who is at the head of the factory. Mr. Wilkins was much pleased to see many of his old acquaintances, and with such energetic men as himself and his brother, Mr. C. M. Wilkins, in the business department, it is no wonder that the company is now doing a greatly increased business over that which it has ever before done.

THE COMMERCIAL ELECTRIC COMPANY, Indianapolis, Ind., had its interests well looked after by Mr. A. D. Adams. Mr. Adams also contributed a valuable paper to the association in addition to looking after his company's welfare.

THE STANDARD PAINT COMPANY, New York, who make the well-known P. & B. compounds, had its interest well taken care of by its western manager, Mr. P. H. Hover.

THE SPERRY ELECTRIC MINING MACHINE COMPANY, Chicago, made a display of Sperry fuse links and copper terminals.

ALEXANDER, BARNEY & CHAPIN, of New York, were ably represented by Mr. H. G. Isertel, who is widely known among the electric lighting and railway industries. At the convention he distributed handsome little boutonierres to gentlemen and corsage bouquets to the ladies. The business of this company is increasing very rapidly under the direction of Mr. L J. O'Rieley, the secretary in charge of the home office and with Mr. Isertel constantly on the road.

MR. GEO. CUTTER, of Chicago, made a handsome display in the corridor of the Southern Hotel. He represented the Germania Electric Company and the Simplex Electrical Company and other important eastern manufacturing companies. He made one of the greatest hit of the convention by presenting the delegates with ornamental representations of what everybody called "Cutter's devils," they looking as much like little imps as possible. It was a humorous spectacle to see the delegates decorated with them. Mr. Cutter was obliged to leave the convention before its close on account of illness, a thing much regretted by his friends.

THE STANDARD UNDERGROUND CABLE COMPANY, Pittsburg, was ably represented by Messrs. J. W. Marsh, of Pittsburg, and Fred E. Dengenhardt, of Chicago. They did not think it necessary to make an exhibit of their wires for those goods are so thoroughly well known everywhere.

THE ANSONIA ELECTRIC COMPANY was well represented by Messrs. F. S. Terry, its manager; D. E. Goe, Chas. Wirt, M. M. Wood, T. E. Theberath and F. M. Pierce, who were on hand renewing acquaintances and making many new ones. The change in the name of the company from that of the Electric Supply Company was the cause of much comment and was duly explained by the representatives of the company present. An exhibit of the Wirt electric meter was made.

The "electrical special" from New York was one of the finest trains ever sent out from New York. Its equipment was elegant, including the coaches, which numbered five. Mr. C. O. Baker, Jr., master of transportation of the N. E. L. A., and Mr. Haines of the Pennsylvannia Railway Company had charge of the train, and everything necessary was provided. The delegates were highly pleased with the care that was taken of them.

The Chicago special, which arrived from Chicago Tuesday morning, was under the care of Messrs. J. Scribner and F. S. Bishop, the latter being the Chicago ticket agent of the Illinois Central Railroad over whose line the train was run. The party numbered something like sixty, and the train in itself was one of the most splendidly equipped in the country. The train regularly known as the "Diamond special," consists of the latest pattern of coach made by the Pullman company which for convenience and elegance is pronounced ahead of anything yet devised for the travelling public. The extra coaches were set aside for the delegates. The delegates on this train were highly pleased with the service and courteous treatment received at the hands of Messrs. Bishop and Scribner.

ELECTRIC LIGHT AND POWER.

EXTENSIONS AND IMPROVEMENTS.

MASON, MICH.--Paddock & Henderson contemplate soon putting in a new engine, heater, and hot water pump.

CHEHALIS, WASH.—The city contemplates adding at once to its electric light plant a commercial arc circuit.

WATERTOWN, WIS.—The Watertown Electric Light Company intends putting in a new 650-incandescent dynamo.

SAN LUIS OBISPO, CAL.—The San Luis Obispo Thomson-Houston Electric Light Company contemplates adding new engines and boilers.

BIG RAPIDS, MICH.—The Big Rapids Electric Light Works will put in this spring an incandescent system.

YPSILANTI, MICH.—The Ypsilanti Electric Company contemplates putting in an engine and boiler; also alternating and arc dynamos.

SANTA CRUZ, CAL.—The Santa Cruz Electric Light & Power Company intends building a new station on the San Lorenzo river for 1,000-horse power water capacity, 3½ miles from city, for the purpose of operating light, railway and power. The flume is to be 5,000 feet, dam 170 feet long and 20 feet high, with a fall of 110 feet.

LITTLE ROCK, ARK.—The city intends adding to its electric light plant an increase of some 60 arc lights.

ABINGDON, VA.—The Abingdon Water Works Company is now putting in a new boiler, and will shortly put in an alternating incandescent system.

CADILLAC, MICH.—The Cadillac Electric & Water Company contempiates putting in a mile of arc circuits and two miles of water main. Geo. E. Lamb is purchasing agent.

PARAGOULD, ARK.—The Paragould Electric Light & Power Company is just installing a 125-horse power compound Russell engine and a 1200-light incandescent dynamo of the National make.

ARCOLA, ILL.—The Arcola Electric Light Plant is to put in an additional engine and an incandescent dynamo.

NEW BEDFORD, MASS.—The New Bedfard Gas & Edison Light Company will, during the spring, combine its two stations in one, and change its engines and boilers.

WHITINSVILLE, MASS.—The Uxbridge & Northbridge Electric Company will install a new boiler.

ALLEGAN, MICH.—The Edison-Allegan Light & Power Company intends putting in larger dynamos and larger turbine wheels.

ROANOKE, VA.—The Roanoke Electric Light & Power Company contemplates building a new station, putting in engines and steam plant.

ARLINGTON, MINN.—The Municipal Plant intends installing larger dynamos and otherwise increasing its generating capacity.

MARSHALL, MINN.—Parsons Bros. contemplate installing a generator and building motor circuits. F. E. Parsons is purchasing agent.

PIERCE CITY, MO.—The Pierce City Electric Light Works will install an alternating dynamo. Geo. R. Armstrong is purchasing agent.

SPRINGFIELD, MO.—The People's Electric Light, Power & Heating Company has been organized, and will at once made contracts for equipment.

SILVERTON, COLO.—The Silverton Electric Light & Power Company will install an arc system.

SPRINGFIELD, ILL.—The People's Electric Light & Power Company, a company recently organized, will begin the construction of lines in April. The arc and incandescent apparatus is yet to be decided on. J. W. Schuek is purchasing agent.

SOUTH NORWALK, CONN.—The city of South Norwalk expects to install an incandescent system at an early date. Jos. A. Volk is chairman.

Mt. Carmel, Ill. —The Mt. Carmel Light & Water Company reports its plant as being under construction. W. S. Reed is president.

Brainerd, Minn.—Wm. W. Deiskell, the superintendent of the Municipal Plant, reports that the capacity of the plant is to be doubled soon.

New Paltz, N.Y.—The New Paltz Electric Light Company will add one 100-horse power engine and one 500 incandescent dynamo. B. Van Stanbergh, 53 Broadway, New York, is manager and purchasing agent.

Jackson, O.—The city electric light plant's incandescent capacity is to be increased. Address Chairman of lighting committee.

Berwick, Pa.—The Berwick Electric Light Company is about to install an incandescent plant. Fred. H. Eaton is purchasing agent.

Titusville, Pa.—The Titusville Electric Light & Power Company may arrange to supply the city with either arc or incandescent lights and power also. F. R. Draw is president and purchasing agent.

Canton, S. D.—The Canton Electric Company which is now operating an arc system, will install an incandescent plant of 1,000 lights. O. S. Gifford is president.

Dayton, Tenn.—The Dayton Electric Light Company may increase its capacity in order to furnish lights for street use. A. J. King is purchasing agent.

Hoquiam, Wash.—The North Shore Electric Company will increase its incandescent capacity this season. J. O. Stearns is purchasing agent.

Port Angeles, Wash.—The City Electric Light Plant is to be operated by water power and its capacity greatly increased. R. R. Harding is general manager.

Snohomish, Wash.—The Snohomish Electric Light, Power & Gas Company may increase its capacity throughout.

Tacoma, Wash.—The Commercial Electric Light & Power Company will add an engine and an incandescent dynamo. Robt. S. Hill is purchasing agent.

Petersburg, Va.—The Electric Light Department Upper Appotomax Co. will add an incandescent day circuit, a 1,500 light alternating dynamo and another turbine. Hill Williams is purchasing agent.

Bellesville, Wis.—The Electric & Water Supply Company contemplates extending its lines and increasing its power. R. F. Kountz is manager.

Watertown, Wis.—The Watertown Electric Light Comany intends to install another 650 light incandescent dynamo. John Kockler is manager.

T mah, Wis.—Messrs. D. A. & C. A. Goodyear, owners of the electric light plant, propose to electrically equip a car for use in their lumber yard.

Grafton, N. D.—The Grafton Electric Light Company will add an engine, and build a new power house. T. H. Thoraldson is purchasing agent.

Walla Walla, Wash.—The Walla Walla Gas and Electric Company have just completed a water power station and will operate an alternating generator and motor.

Marshall, Mo.—The Marshall Electric Light and Power Company are to install an entire equipment for an electrical light plant. T. E. Wardell is manager.

THE ELECTRIC RAILWAY.

EXTENSIONS AND IMPROVEMENTS.

Washington, D. C.—The Eckington and Soldiers' Home Railway Company will construct five miles of track. E. E. Winters is superintendent.

Rome, Ga.—The Rome Street Railroad Company is adding one and one-fourth mile of track. J. S. Lawrence is president.

Sioux City, Iowa.—The Sioux City Street Railway Company will add ten motor cars to its equipment, I. B. Walker, superintendent.

Waverly, N. Y.—The Susquehanna Valley Electric Railway is in process of construction. Its length will be seven and three-fourth miles. It will be in operation July first. A. C. Wade is secretary.

Birmingham, Ala.—The Birmingham Railway and Electric Company will electrically equip a portion of its present steam line, construct fifteen miles of electric and forty miles of steam track, besides materially increasing its rolling stock.

West Bay City, Mich.—The Bay City line is being electrically equipped. W. B. McKinley is manager.

Savannah, Ga.,—The Electric Railway Company of Savannah will increase its plant and equipment by adding cars, motors, dynamos, engines and boilers. J. W. McFarland is superintendent.

Washington, D. C.—The Brightwood Company will construct one and one-fourth mile of additional track. V. B. Deyber is secretary.

Radford, Va.—The Radford Street Railway Company will add about two miles of track soon. M. A. Riffe is president.

Hot Springs, Ark.—The Hot Springs Electric Light Company expect to furnish power to street car line by April 10th.

Gloversville, N. Y.—The Fonda & Fultonville Electric Railway Company will lease its road when constructed to the Cayudutta Electric Railway Company. T. C. Frenyear is manager.

Columbia Pa.—The Columbia & Washington Street Railway Company will soon construct four and one-half miles of track. Andrew J. Kauffman is president.

Binghamton, N. Y.—The Binghamton Street Railway Company is rebuilding and extending its road, constructing a new power house, putting in new engines and boilers and increasing its rolling stock. G. T. Rogers is president.

Dubuque, Ia.—The Dubuque Electric Railway was sold by orders of U. S. Court March 13th. Upon confirmation of sale the new company will assume possession. Horace Poole, receiver.

Florence, Colo.—The Florence Rapid Transit & Power Company is securing franchises and making light and power contracts. A four mile track will be constructed. James A. McCandless is president and manager.

Peoria, Ill.—The Lakeside Electric Railway Company will double track its entire road. John Finley is manager.

Rockford, Ill.—The West End Street Railway Company will construct about three miles of track this season. J. S. Ticknor is manager.

La Fayette, Ind.--The LaFayette Street Railway Company will add a 250 h. p. engine and boilers, ten cars, new power plant and construct five miles of track. J. S. Hill is manager.

Shenandoah, Pa.—The Lakeside Railway Company will begin the construction of its road soon. The road will be seven miles in length.

Lowell, Mass.—The Lowell & Suburban Street Railway Company will construct nine miles of additional track this spring. E. M. Tucke is manager.

Ann Arbor, Mich.—The Ann Arbor Street Railway Company will ask for a franchise to extend its lines. In case the petition is granted the necessary capital will be secured by the issue and sale of bonds. H. F. Morton is general manager.

Sedalia, Mo.—The Electric Railway, Light & Power Company have purchased two additional motors and two miles of track will be constructed this spring. D. C. Metsker is manager.

Amsterdam, N. Y.—The Amsterdam Street Railway Company propose to construct nearly four miles of additional track this season.

Buffalo, N. Y.—The Crosstown Street Railway Company contemplate the addition of 50 miles of track and the necessary equipment. Its present line is 41 miles in length. H. H. Littell is president and manager.

Youngstown, O.—The Youngstown Street Railway Company have begun the construction of three and one-half miles of track, on the south side and three miles additional, to Girard, will be built during June and July next. F. Wayland Brown is manager.

Wheeling, W. Va.– The Wheeling Railway Company has completed a fine new power house, re-equipped its entire system and added 15 new cars. Five miles of additional track will be constructed.

Mr. Frederick A. Scheffler, who has for some time been superintendent of the Brush Electric Company, has tendered his resignation taking effect April 1. Mr. Scheffler has, for several years, been actively identified with the manufacture of electrical apparatus, having for a number of years previous been engaged in the production of steam engines and boilers. His address is Passaic, N. J., care E. K. Rose.

BUSINESS NOTES.

The Ball Engine Company, through its Chicago office 506 The Rookery, recently sold to the Hammond Electric Street Railway Company a 150-horse power engine.

The Ansonia Electric Company, Chicago, is preparing at a considerable expense a book of tables, many of them new and original. The book will also contain other information valuable in electrical work.

Geo. Cutter, Chicago, has brought suit against the Carpenter Heating and Manufacturing Co. on account of its enameled devices, asking that the Carpenter patent be set aside and that an injunction be granted with accounting.

L. K. Comstock has just commenced work on the New Era Building; a new store and office building on Harrison street. Interior conduit is used throughout. The Siemans & Halske Electric Company has the contract for the dynamos.

The Partrick & Carter Company, Philadelphia, has recently received orders for its well known patent needle hotel annunciators; one 300 numbers, three 150 numbers, two 114 numbers and five 100 numbers. These annunciators are to be installed in the the World's Fair and resort hotels.

The Electric Selector & Signal Company, 45 Broadway, New York, has acquired the property, patents, business and good will of the Electric Secret Service Company and will conduct its business under the same general administration as before, Mr. C. P. MacKie being the manager.

Queen & Co., incorporated, Philadelphia, report a steady demand for their standard portable resistance sets, especially set No. T 305, which is a most efficient set for practical use. It is specially adapted for use in locating faults or grounds in electric light, telephone or telegraph lines.

The W. S. Edwards Manufacturing Company, of Chicago, has removed its sales rooms from the corner of Lake and Jefferson street to 21 and 23 East Lake street. An isolated lighting plant is being put in and the building fitted preparatory to removing the factory to the same address.

The Ball Engine Company, Erie, Pa., is to furnish four 150-horse power engines for the electric lighting plant of the Mackaye Spectatorium of the Columbian Celebration Company which is to be one of the most unique and interesting features of the Columbian Exposition and it is claimed will be to the Fair what the Eiffel Tower was to the Paris Exposition of 1889.

J. Lang & Company, Chicago, manufacturers of central station switches, report that they have for the last six months been extremely busy, being compelled to run continuously at their fullest capacity. At present they are unusually busy filling orders for the trade, which include some of the largest central stations in Chicago and elsewhere, a number of which use the Lang switches exclusively.

The F. P. Little Electric Construction and Supply Company, Buffalo, N. Y., has purchased from the A. H. Atwood Electric and Manufacturing Company, of Chicago, the arc lamp formerly made by that concern, the purchase consisting of all the lamps, patterns, machinery, etc., used in its manufacture. The plant has been removed to Buffalo, where the manufacture of the lamp will be continued.

The Crocker-Wheeler Company, New York City, has purchased the plan of the Spiral Weld Tube Co., at Newark, N. J. It will immediately remodel the factory. The plan adopted dispenses as far as possible with belts and shafting, by connecting each machine, wherever practicable, direct to a motor. This plan will result in a great saving of power which will be lost in transmission, also in the cost of keeping belts and shafting in repair.

Mr. W. H. Gibson, the Chicago manager of I. B. Davis & Son, Hartford, Conn., has recently taken a very large number of orders forthat firm's well known feed water heaters and purifiers among electric light, railway and power plants. Some of these heaters have been especially large, he having sold altogether over 15,000-horse power since the beginning of the year. Mr. Gibson has all the business he can well attend to, the best evidence of the quality of the goods he sells.

The Central Electric Co., 116 and 118 Randolph St., Chicago, is making a fine exhibit of Lundell motors. It has one coupled to a generator which generates a current supplying lamps, fan motor, and the Lundell exhaust outfit. The company reports a new demand for Okonite wire for cars. The new and palatial private car of President McLeod, of the Philadelphia and Reading, built by the Pullman company, has just been wired throughout with Okonite. Johnson switches were also used.

The Phœnix Iron Works Company, of Meadville, Pa , reports among its March sales the following Dick and Church tandem compound engines: Carnegi Steel Co. Lt., Pittsburg, Pa., two condensing engines of 150-horse power each; Eohey & Sons, Jamestown, N. Y., two non-condensing engines of 150-horse power each; Trumbull Electric Railway Co., Warren, Ohio; one non-condensing engine of 150-horse power; Salt Lake City (Utah) Electric Light Co., one non-condensing engine of 115-horse power.

The Jenney Electric Motor Company, Indianapolis, Ind., has appointed Mr. A. H. Goode manager of its Chicago office with headquarters at 932 Monadnock Building. Mr. Goode will be pleased to have his friends call upon him in his new quarters and will also be glad to answer any correspondence that may be addressed to him from this territory. The company announces that the World's Fair edition of its catalogue is now ready for the press and will be ready for distribution at an early date.

The Knapp Electrical Works, Chicago, have recently had a special rush on needle annunciators and are now working over time to fill orders, as they have under course of construction a large number for the World's Fair hotels, amounting to about 5,400 indications. They are now building a 650 number annunciator for the Hotel Epworth, Chicago, one of the largest ever put in in the west. At present they are making a specialty of elevator outfits, finding a large and also growing demand for them.

The Ansonia Electric Company, Chicago, in order to take care of its friends and customers during the World's Fair has organized a department called the "World's Fair Bureau," placing in charge of this Hon. Geo. B. Shaw, who is well known in electrical circles through his former connection with the National Electric Manufacturing Company. The company announces that this department will be pleased to hear from friends and that it will be glad to give them any possible assistance either before or during their visit to the fair.

The L. Blatz Brass Works Chicago, in order to keep pace with their rapid increase of business have again made extensive additions to their plant. This plant is now running twenty furnaces in addition to its foundry, a well equipped finishing department is also in operation. The firm was among the first to do extensive work in the production of brass supplies for electric railways and its trade and reputation has grown in a most satisfactory manner. The rapid progress which the firm has made since its establishment speaks in the strongest terms of its push and energy.

The Chicago and St. Louis Electric Railway has let contracts for the construction of its two tracks between Chicago and St. Louis. Work, it is claimed, will be begun at once, or as soon as the weather will permit. Stock, in this enterprise, is selling rapidly, and investors who subscribed for the first issue of stock are highly pleased with the investment, so it is said. The company, as recently planned, has opened its subscription books for the third time, stock selling at $6 per share. The books will close April 10, as announced in the advertising colums of this issue.

The Vilter Manufacturing Company, Milwaukee, announces that it will hereafter under this name carry on the business formerly conducted by the Weisel & Vilter Manufacturing Company with the same officers of that corporation. It will be remembered that this company had its works totally destroyed by fire in October last. Not discouraged, however, by this adversity the company immediately built a new factory on a much larger scale, equipping it with the most improved tools and machinery. Corliss engines for electric lighting and railway service will be one of its leading specialties.

The Patton Motor Co., Chicago, proposes building an electrical engine of 500-horse power capacity and a minimum speed of 50 miles per hour with a view to test the practicability of this system in handling regular steam railroad cars. Bids are now being received by the company for the dynamos and storage-batteries to be used in the construction of the engine, but as yet no contracts have been made. It is expected that a trial trip will be made between Chicago and New York about the first of September next. Rumors that Pullman's Palace Car Co., is interested in the project are denied by the officials of that company.

The Central Electric Company, Chicago, has just placed on the market a hard rubber hydrometer which is pronounced to be superior to the old glass form. The company announces to the trade that it has for distribution monthly, the Architects Bulletin, published by the Interior Conduit & Insulation Company, giving a brief description of the principal buildings in the country in which the complete system of conduiting and Okonite wire has been placed during the previous month. This bulletin will no doubt prove of interest and profit to contractors and others and the company will be glad to mail one regularly each month free of charge to any one sending their card.

The Joseph Dixon Crucible Company, Jersey City, N. J., has been awarded space in the Mines Building of the World's Fair, the space being 25 by 28 feet. In this space the company will make a general exhibit of graphite products, such as crucibles, lubricating graphite, graphite axle grease, plumbago facings, graphite machine and railway grease, graphite cylinder oil specialties for electrical and other work, etc. In the Manufacturers Building the company has also space 13 by 10 feet, in which it will make an exhibit of Dixon's American graphite pencils and pencil sundries. Although the space is less than the company at first desired it will make a nice display and have its exhibits ready on time.

The Stirling Company, Chicago, manufacturers of the Stirling water tube boiler, report a very large number of recent sales. Among this number are the following: 400-horse power to the Bay City Consolidated Street Railway Company, Bay City, Mich.; 250-horse power to the Hot Springs Electric Light Company, Hot Springs, Ark.; 600-horse power (second order) to the Consolidated Street Railway Company, Toledo, O.; 2700-horse power to the Lindell Avenue Street Railway Company, St. Louis, Mo. This company, owing to the large number of castings required in their manufacture of boilers, has been compelled to build a new foundry wherein all the castings used are now made. This foundry has just been started.

The Mica Insulator Company was incorporated on the first day of March at Elizabeth, N. J., the authorized capital stock being $100,000, all paid in. The plant of the company is located at Schenectady, N. Y., while its office and sales room will be at 218 Water street, New York City. The officers are Eugene Munsell, president, Franklin Brooks, vice-president, and Lewis W. Kingsley secretary and treasurer. The company will manufacture micanite for electrical insulation, a description of which appeared in these columns recently. Through a process controlled by this company small scrap mica is now utilized in all forms and shapes for insulating purposes where sheet mica was formerly used, the cost being less and it is claimed with no diminution in efficiency.

The Southern Engineering Company, Louisville, Ky., report that they have issued a warrant for the arrest of C. P. Hayes on the charge of forgery and obtaining money under false pretences. This man, it seems, was employed by the company as electric wireman for sometime and for two weeks previous to March 14th, occupied the position of local solicitor. On the 14th of the month he left that city after defrauding several people. The company desire to effect his arrest and prosecute him as they have learned that he is a notorious rascal. He is described as a man of 5 feet 11 inches in height, weight about 160 pounds, long curly hair of a reddish brown color, and dark blue eyes. Any information regarding him should be addressed to W. H. Owens, Chief of Detectives, Louisville, Ky.

The Chicago Rawhide Manufacturing Company, Chicago, is extremely busy in filling orders for its well-known dynamo belts, rawhide ropes for power transmissions, and other of its specialties. The dynamo belt made by this company is becoming to be a great favorite with electric light people for the reason of its great lasting qualities and the fact that it is a non-conductor of electricity. It does away with static electricity when in operation. The company is now getting out a complete outfit for a large electric lighting plant in England recently ordered by cable. A handsome exhibit will be made at the World's Fair in Machinery hall of all its various kinds of goods besides which the company will also have a large number of belts operating machinery of different kinds throughout the exhibition grounds.

The Electrical Installation Company, Monadnock building, Chicago, has been organized about a month and although it has been in the field for such a short space of time it has already secured several large street railway contracts. The company will do a general engineering business both as consulting and contracting engineers making a specialty of railway and lighting installations. The company has elected officers as follows: J. I. Case, president; C. H. Holmes, vice-president; L. E. Myers, secretary and treasurer; A. L. Shewman, general manager. The offices of the company have established in the Monadnock building, and are completely and elegantly furnished. It is the intention of this company to furnish with each proposal complete detail drawings of the work proposed, a feature which railway and lighting companies will certainly appreciate, particularly those just starting on their first installation.

The Indiana Rubber and Insulated Wire Company has removed its office from 242 Madison street, Chicago, to Marion, Indiana, from which point it will hereafter transact all business and receive all communications, and with the telephonic communication with its factory in Jonesboro, a few miles distant, they will be better able to do justice to its rapidly increasing business. This company about a year ago opened its sales office in Chicago for the introduction of its Paranite insulations, then but comparatively unknown to the trade. Being the only manufacturer of rubber-covered wire west of the Allegheny mountains it found a convenient and ready market for its product, which is now sold extensively throughout all the middle and western states, and is in the hands of the supply houses in all large cities. The Electric Appliance Co. of Chicago its general Western agents, will continue to carry a large and complete stock of all sizes as heretofore.

The Great Western Manufacturing Company, Chicago and Duluth, has just secured an order for two direct coupled slow speed generators from the Patton Electric Manufacturing Company. These generators are to be used on the cars which the Patton Company will equip to run from Pullman to Jackson Park during the World's Fair. The wire factory of the Great Western company located at Sycamore, Ill., is pushed to its utmost capacity at present in the manufacture of its well known weather proof and magnet wires, having been compelled during the last two months to run night and day. The high quality of its weather proof wire is recognized by the trade as evidenced by the large number of orders received. A very large contract has just been let to this company for rewinding and repairing all the dynamos recently injured in the fire of the Des Moines Water & Power Company, the work on them now being well under way at its Duluth works.

The Detroit Electrical Works, Detroit, Mich., report that their single reduction motor recently put upon the market is meeting with great success. Many important sales of this type of motor have already been made, although it has never been advertised. Tests made by the Detroit Citizens' Railway Company between the "Detroit" single reduction and single reduction of two other makes proved beyond argument the high efficiency of the "Detroit" motor, and resulted in that company getting an order for forty 50-horse power and twenty 30-horse power equipments. Besides this they have recently secured contracts through their Chicago office for three 150 K. W. generators and six 30-horse power motors from the Belle City Street Railway Company of Racine, Wisconsin, and two 100 K. W. generators and nine 30-horse power motors from the Fox River Railway Company at Green Bay, Wisconsin, besides numerous other orders.

The Ansonia Electric Company, corner Randolph and Michigan Ave., Chicago, has recently secured contracts for the complete electrical apparatus for several of the large hotels now being built for the accommodation of World's Fair visitors. One contract includes a 250 number Ansonia gravity needle annunciator. It has also sold a large number of Diamond carbon batteries and Eureka bells. It has a distinctive railway supply department which is fully alive to all the requirements of their railway friends. It has the contract for the overhead construction of the crosstown lines of the Chicago City Railway Company. There will be over one hundred and twenty miles of crosstown electric road, which will be completed by the first of May, when the Fair opens. It handles electric radiators and heating apparatus, which is especially adapted for this time of the year when it is not cold enough to keep up furnace fires and is a most convenient substitute to those having electric current available.

Wm. Baragwanath & Son, 55 W. Division St., Chicago, are at present very busy filling orders for its wellknown feed water heaters and purifiers, being compelled to run an extra force of men. This is shown from the orders recently received which have either been shipped during the past month or are under construction and nearly ready for shipment: 1,000 horse power heater for Utah; four large heaters for the World's Fair; two large heaters for the Chicago City Railway, one of which is 1,500-horse power; one 600-horse power heater for the Southern Railway, St. Louis; one 400-horse power heater for East St. Louis; a 15,000 horse power heater for the Illinois Central Railroad; five super heaters for Pekin, Ill.; a 600-horse power heater for Philadelphia; besides 29 other heaters for various other points just shipped or under construction; also two 1,000-horse power heaters for the Auditorium annex, Chicago. These latter heaters were designed especially for this plant and are a radical departure in such devices as they combine both a heater and receiving tank. Economy of space is thus secured as well as high efficiency.

E. M. Wilson & Company proprietors of the Lamokin Car Works have recently made sales of their cars to the following: The Philadelphia Traction Company, Philadelphia, Pa., thirty 20 feet open cars, mounted on open trucks; Rome Street Railway Company, Rome, Ga., one closed and three open cars; Wilmington City Railway Company, Wilmington, Del., fifteen open cars; Union Railway Company, Chester, Pa., ten open cars; Citizens Passenger Railway Company, Harrisburg, Pa., six 18 feet closed vestibule cars and two 9 seat open cars mounted on Robison trucks; East Harrisburg Passenger Railway Company, Harrisburg, Pa., nine 25 feet closed vestibule car bodies; Greensburgh & Hempfield Railway Company, Greensburgh, Pa., one 16 feet closed car body; Richmond County Belt Line, Augusta, Ga., five open cars; East End Passenger Railway Company, Williamsport, Pa., two 16 feet closed vestibule cars. The company is also finishing cars for the Schuylkill Traction Company and besides has numerous orders for deliveries in August and September, being compelled at present to run nights to keep up with orders.

The Ball Engine Company, Erie, Pa., reports that it is crowded with orders and has made some unusually large shipments of its well known engines for this season of the year. Some of its recent shipments are as follows: L. M. Rumsey Mfg. Co., St. Louis, Mo., two 35 horse power engines; Midvale Steel Co., Nicetown, Pa., one 130-horse power engine; General Electric Co., Tucson, Arizona, one 130 horse power engine; Lakewood Casino Co., Lakewood, N. J., 50 horse power steam plant; Calumet Street Railway Co., Chicago, Ill., four 300 horse power cross compounds; Wheeling Street Railway Co., Wheeling, W. Va., three 250-horse power cross compounds; Western Light & Power Co., Chicago, Ill., one 300-horse power engine; Risdon Iron Works, San Francisco, Cal., three 150-horse power tandem compounds; Cienfuegos, Cuba, one 60-horse power engine; Nantasket Steam Boat Co., Boston, Mass., three 25-horse power engines and one 35 loop; Griggsville Electric Co., Griggsville, Ill., one 50-horse power steam plant; Frank Jones Bldg., Cincinnati, Ohio, one 35-horse power engine; Hahne & Co., Newark, N. J., one 35-horse power engine; Hammond Electric Street Railway Co., Hammond, Ind., one 150-horse power steam plant; Logansport Electric Light Co., Logansport, Ind., one 130-horse power engine; Combination Mining and Milling Co., Philipsburg, Mont., two 35-horse power engines; Doylestown Electric Light Co., Doylestown, Pa., one 100-horse power engine; Macon & Indian Spring Railway Co., Macon, Ga., one 150 horse power steam plant; Dayton Mfg. Co., Dayton, Ohio, one 100-horse power engine; Cooley & Vater, Duluth, Minn., one 80-horse power engine; Seabury & Johnson, East Orange, N. J., one 25-horse power engine; Produce Exchange Co., New York City, one 25-horse power engine; Edison Electric Illuminating Co., Mt. Carmel, Pa., one 100-horse power engine; The Blakely & Dickson Traction Street Railway Company, Scranton, Pa., 300 horse power engines; The Casa Alameda Hotel, 63rd and Columbus Ave., New York, two 80-horse power engines; The Tampa Street Railway & Power Company, Tampa, Fla., one 200-horse power cross compound; The Bloomsburg Electric Light Company, Bloomsburg, Pa., 100-horse power engine, recently installed through J. W. Parker & Company, its Philadelphia agents.

(Business Notes continued on page 52.)

ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. May, 1893. NEW YORK. No. 5.

The Opening of the World's Columbian Exposition.

A little after 12 o'clock on May 1st President Cleveland pressed the golden electric key which started the big 2,000 horse power Allis engine in Machinery Hall. At this signal the flags in all parts of the grounds were unfurled, whistles blown, cannons fired, and fountains played, marking the formal opening of the World's Columbian Exposition. Assembled to witness this ceremony were representatives from all nations and from all walks of life. Thus the Exposition signified its readiness for the reception of visitors.

Electrical Industries

OPENING OF THE WORLD'S COLUMBIAN EXPOSITION—VIEW IN FRONT OF ADMINISTRATION BUILDING DURING PRESIDENT CLEVELAND'S ADDRESS.

The visitor will feel even now amply repaid for his visit to the grounds where he will find a sufficient number of exhibits to occupy his attention for a number of days to say nothing of the beauty of the grounds and buildings which will require a considerable time to see and appreciate. The Exposition is in every department the greatest ever known. There is no part of the earth to which its messengers have not gone in searching for curiosities and articles of interest with which to fill its mammoth buildings.

In the construction of its grounds and buildings an army of men has been employed for nearly two years and the amount of money expended reaches nearly $20,000,000, a sum several times as large as that expended in any previous exposition. It is estimated that one-third of a million of people entered the grounds on the opening day, one-fourth of whom witnessed the opening ceremonies. The transportation facilities will increase as the employes and officials of the different roads become better acquainted with their schedule and more accustomed to the handling of a large crowd. The present facilities will be increased by the addition of a number of boats and trains so that persons may go to the grounds easily and conveniently and on their arrival there will find ample accommodations for their needs. With the large number of visitors in the city no difficulty was found in securing ample hotel accommodations at reasonable rates and no trouble will probably be found at any future time during the Exposition in securing accommodations of the kind desired either at hotels or in private families.

The engraving which we present is from a photograph taken during the cermonies and shows President Cleveland in the act of opening the Fair. From this illustration our readers who were not present will be able to obtain a good idea of the enormous crowd in attendance.

The Exhibits in Electricity Building.

The arrangement of the display in the department of electricity is not quite completed, but is being pushed forward as rapidly as possible. Various circumstances have combined to delay the installation of the exhibits. The immense amount of freight that has been received during the past ten days from all parts of the world has taxed to the utmost the facilities for handling it. The condition of the weather that has changed the roads into rivers of mud, delaying traffic, and the strikes of the different labor organizations have each hindered the work. Nevertheless a large amount of work has been done; and the assurance is given that the building will be in presentable shape within the next few days. Already one may gain an idea of the elaborateness of the exhibit, which will be many times the largest display of electrical apparatus ever made. The products of all the prominent manufacturers will be displayed. The exhibits made by France, England and Germany are large, and will be especially interesting as showing the relative advancement in the manufacture of electrical machinery in the different countries. Power is supplied in the shape of electricity from the generators in Machinery hall by which the different kinds of apparatus are shown in actual operation. By the tasty arrangement of electric lights in the way of signs and figures many attractive features have been introduced. It will also be interesting from a historical point of view on account of the number of original machines, models, drawings, and patents that have been collected. Accommodations for the reception of visitors have been provided by a number of exhibitors that will undoubtedly be greatly appreciated.

The exhibits in connection with the telegraph and telephone will be quite complete and very interesting. The Western Union Telegraph Company and the Commercial Cable Company have gone to considerable expense in arranging their exhibits, which will illustrate the history of the inventions as well as the perfection of the modern systems and apparatus. The exhibit of the Commercial Cable Company has been arranged under the direction of Mr. Charles Cuttriss, an electrician in the company's employ who has spared neither time nor expense in making the exhibit as interesting and instructive as possible. The American Bell Telephone Company has erected a building which covers something over 6,000 square feet of floor space, in which are illustrated not only the different systems of this company and the modern apparatus employed, but also shows by models and samples the original inventions, which it owns and controls, besides models and drawings showing the gradual growth of the instruments into the perfected mechanisms of to-day. This building is constructed of staff and stands directly within the southern entrance of the Electricity building. Other apparatus in the same field will be exhibited by the Elgin Acoustic Telephone Company, Elgin, Ill., which has taken considerable pains to make an attractive exhibit. The Strowger Automatic Telephone Exchange, Chicago, shows a system which it has recently perfected and placed on the market, and which will be shown in practical operation. In this system the connections are made automatically by the subscriber pressing the buttons connected with the central station.

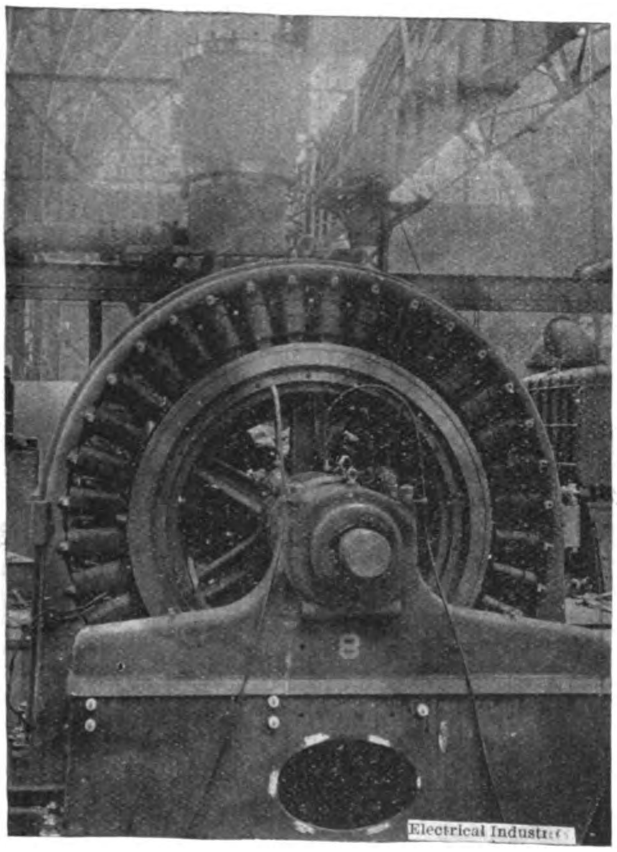
Electrical Industries

CHIEF J. P. BARRETT AND STAFF, DEPARTMENT OF ELECTRICITY.

Mr. O. L. Wullweber, Chicago, exhibits apparatus for use in connection with the telephone. This apparatus is so arranged that the operator is not obliged to hold the receiver to his ear with his hand, which allows him the free use of both hands for making memoranda, etc. Besides this appliance there is a paper holder and writing tablet, which is very useful in connection with the use of the telephone. Mr. Louis Casper also shows an apparatus in connection with the Wheatstone system by which the telegraphic signs are marked on a tape by an automatic device operated by three large magnets receiving the current from a small dynamo. To the magnets are connected three small piano-shaped keys by the operation of which the signals are transmitted and recorded.

The North American Phonograph Company exhibits over forty phonographs illustrating their adaptation for commercial use in various ways and also the apparatus intended for household use and amusement. Another exhibit which has only recently been brought to the attention of the public is that of the telautograph, the invention of Prof. Elisha Gray. These instruments will be shown in operation illustrating the various uses to which it is adapted. The complete exchange system will be shown as well as its operation on isolated lines and long distance service.

The Jenney Electric Motor Company, Indianapolis, Ind., has erected a very attractive booth which is ornamented by a handsome arrangement of incandescent electric lights. In this booth the company will entertain its visitors. The exhibit will consist of motors of the several designs and sizes which it manufactures. The switchboard, from which the different motors are regulated, is constructed of hard wood with white Italian marble panels. The main line and branch switches, current indicators, safety appliances, regulating rheostats, etc., are all handsomely finished and of the latest designs. One 30 kilowatt 500-volt motor coupled direct to a 50 kilowatt 110-volt generator and one 20 kilowatt motor coupled direct to a 20 kilowatt generator will be used to furnish light and power for motors in this and neighboring exhibits. Automatic motors from one-half to 12-horse power, a three kilowatt lighting dynamo and a three-horse power electro depositing dynamo will be shown. A representative of the company will be in constant attendance to welcome visitors and give any information in regard to the exhibit desired.



WESTINGHOUSE GENERATOR COUPLED DIRECT TO ENGINE.

The Rockford Electric Manufacturing Company, Rockford, Ill., will exhibit in connection with the Standard Electric Company in which a 40-horse power iron clad motor will be connected to arc dynamos. The company has also installed a 25-horse power iron clad motor belted direct to the Scott perfecting press which is used to print the official World's Fair newspaper. These machines will be located in Machinery Hall. The motor will be equipped with field regulators, by which the speed can be varied, and in connection with it some new ideas in rheostats will be illustrated.

The Pelton Water Wheel Company, San Francisco, Cal., will exhibit in the Electricity building, showing in actual operation two styles of the Pelton water wheel, one of which will be made in connection with the General Electric Company's exhibit. This wheel will be 32 inches in diameter and runs at 750 revolutions when under a 650 foot head. The wheel will be directly connected to a multiphase electric dynamo. In connection with the Westinghouse Electric Company's exhibit will be shown also a 34 inch double nozzle Pelton wheel, that runs at 600 revolutions when under a 460 foot head. This will be coupled direct to the armature shaft of a Westinghouse dynamo to show the method of electrical transmission by means of water power. These two combinations will undoubtedly excite considerable interest.

Mr. John F. Hurd exhibits an electrical detector designed for the purpose detecting coat thieves and pick pockets. By the use of this instrument any attempt, it is claimed, to purloin a coat or to remove articles from clothes in a wardrobe are instantly detected by the sounding of an alarm.

Mr. Carl L. Sponholz, Lowell, Mass., shows a telephone directory for the use of telephone subscribers. By its use they are enabled to more readily find the name and number of a subscriber than by the use of the ordinary directory. It is made with cases of ash, oak, cherry, or white wood or designs in special kinds of wood are made if desired. Another directory is made in book form which can also be used as a shipper's or book-keeper's index.

M. de le Fere, Minneapolis, Minn., exhibits a system of rapid transit which has recently been designed by him. The exhibit will consist of a number of tracks in a circular form upon which the model of his trains will run. The tracks will be equipped with an improved system of signals and switches of his own design. The model of the car runs upon a single rail with electricity as its motive power. The car is designed to present the least amount of resistance to the atmosphere. Very high speed is claimed for this style of car but no large road has been so far constructed to demonstrate its speed or economy. Mr. de le Fere will also exhibit a number of other inventions and devices which undoubtedly will be interesting.

The McIntosh Battery & Optical Company, Chicago, makes a fine display of medical and electrical batteries and appliances. Special attention has been given to the quality and finish of the various goods. The wood work of the battery cases and cabinets has been prepared with great care and pains. There is also shown a full line of McIntosh portable galvanic, faradic and combined galvanic faradic batteries. Quite a display is also made of electrical apparatus and instruments for use in schools to show the principles connected with the electric current.

The Siemens & Halske Electric Company, Chicago, makes an exhibit in the Electricity building of regulating instruments, telegraph, telephone apparatus, etc. In connection with the German government it displays a number of machines and instruments having a historical interest. In the Transportation building a complete block and signal system, electric switches, annunciators, etc., is shown. It has installed a 1000-horse power generator coupled direct to a compound condensing engine in Machinery hall together with a number of multiphase generators and motors, and high speed machines.

The General Electric Company occupies some 16,000 square feet of space in the center of the main floor of the Electricity building in the display of the various apparatus that it manufactures. In the center of the building in connection with the Phoenix Glass Company it makes one of the most prominent and striking exhibits. The booth, above which rises a tower ornamented by thousands of incandescent lamps arranged in various ways by the General company, the Phoenix company will display glass of differshapes and by the electrical arrangement will show a variety of colors. The shelves in the interior will be of mirrors on which will be the latest novelties from the works of this company. The main exhibit of the General company will be divided into departments, each department making a complete exhibit of everything in its line, the motors and generators, street car trucks and electrical locomotives in several styles. In fact, almost every kind of apparatus in connection with which electricity is used, will be displayed by this company. The exhibit in the Electricity building will only be a part of the General Electric Company's exhibit. In the Transportation building, in Machinery hall, and in other places will be shown products of its factories. The efficiency of its railway apparatus will be practically tested on the Intramural road.

An elaborate display of Day's kerite wires and cables is made. A number of finely finished display counters and also a booth make the exhibit attractive. Samples of the various kinds of wires and cables are so displayed that the method of construction is shown.

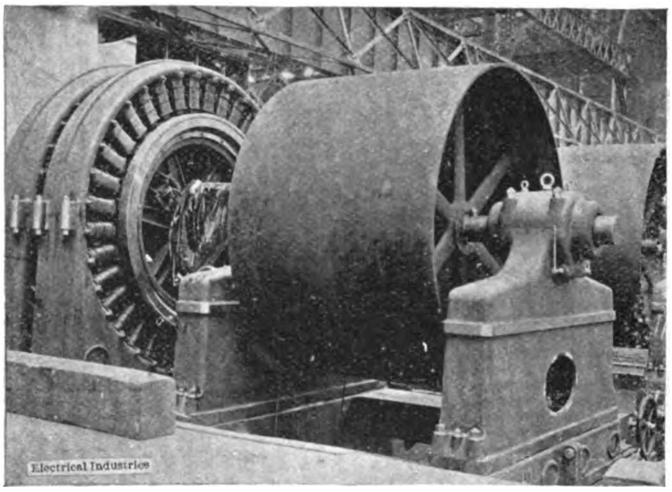
Electrical Industries

GENERATOR IN CENTER OF GENERAL ELECTRIC CO'S EXHIBIT.

The Ansonia Electric Company, Chicago, has erected a large and handsome pavilion, of Moorish design, covering about 1,600 square feet of space. It is located on the second floor of the Electricity building, between the two cafés. The company has planned an exhibit which will be of interest to the people at large as well as the electrician. In the exhibit are a number of the earlier forms of dynamos and other apparatus of historical interest. One of the pagodas of the Moorish pavilion will be occupied by the American Electric Heating Company, whose appliances will be shown in actual operation, consisting of apparatus for domestic use, including culinary attachments for both the home and hotel. Among the other companies whose manufactures will be exhibited in this pavilion are the Cutter Electrical & Manufacturing Company who will exhibit a full line of new and novel switches; the Star Electric Lamp Company exhibiting their new lamps operated by an automatic switch; the Electrical Manufacturing Company, Dayton, O., by whom will be exhibited a full line of Fletcher specialties; the India Rubber & Gutta Percha Insulating Company making a fine display of Habirshaw wires; the Electrical Thermostat Company, Minneapolis, Minn., which exhibits a miniature dwelling with radiators, furnace, and automatic electric heat regulating devices in actual operation; and J. Lang & Company making a complete exhibit of switches from the smallest to a capacity of 1,000 amperes at 1,000 volts. A Frisbie electric elevator has been installed near this pavilion, by which passengers will be carried from the lower floor to the exhibit. The pavilion will be under the direct charge of Mr. Geo. G. Carter, who will welcome visitors and, with his assistants, explain the different kinds of apparatus shown.

The New England Butt Company, Providence, R. I., exhibits in operation a number of its machines insulating electric wires. The new magnet wire winding machine, recently brought out by the company, will attract special attention, as in its construction several entirely new features are employed. The large braider for covering cables and wire with coarse cotton or jute, will also be of interest. A machine for measuring wire, designed for factory or general use, forms a part of the exhibit. These machines are all finely finished and show the skill employed in their manufacture. The machinery in this exhibit will be run by a motor.

The Westinghouse Electric & Manufacturing Company has secured an increase of space in the Electricity building and on that account it will rearrange its entire display which will delay its installation a little. Samples of the various kinds of apparatus manufactured will be displayed, although the exhibit in the Electricity building will not be as elaborate as it otherwise would were it not for the large amount of its apparatus used in the electric lighting plant which lights the exposition grounds and buildings.



TWO WESTINGHOUSE DYNAMOS RUN BY ALLIS ENGINE.

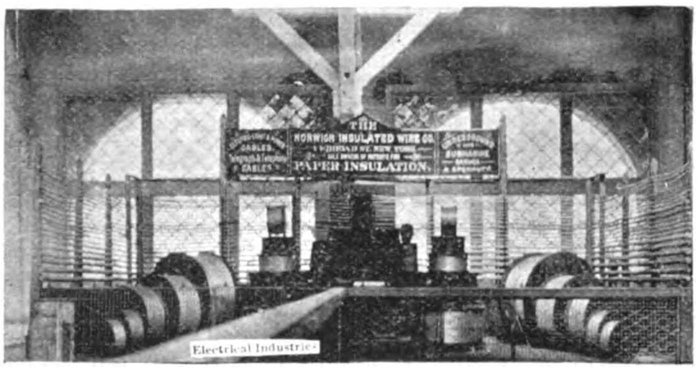
The Eddy Electric Manufacturing Company, Windsor, Conn., has arranged a number of motors and generators of various sizes showing the different styles of electric light, power, and railway generators which it manufactures. It has also installed for the use of the Exposition company four 250-horse power 500-volt generators. The different machines in its exhibit will be shown in operation, generators furnishing electricity for light and power and motors furnishing power for generators, etc.

The CentralElectric Company, Chicago, is making a display of the specialties for which it is the western agent. Among the specialties which will be shown are the many products of the Okonite Company including wires, cables, tapes, etc., used in electric lighting and railway work; also the interior conduit, Lundell motors, etc., manufactured by the Interior Conduit Company. The exhibit will altogether be very creditable not only to the Central company, but to all the various interests represented.

The Norwich Insulated Wire Company, New York, exhibits over 100 specimens of lead covered cables on brackets and reels. All the standard sizes of cables used by telephone, telegraph, electric light and power and street railway companies are shown. The special feature of the exhibit is that the insulation is paper which is said to give an excellent test, both for resistance and electro-static capacity. Special pains has been taken in the installation of the exhibit to make it look as attractive as possible.

The Electric Selector & Signal Company, New York, makes a complete exhibit of the principle of individual electrical selection in its several applications. There is shown in operation on a scale, under the conditions of every day practice, a number of railroad semaphores and train order signals, six telegraph stations, six arc lights, several groups of incandescent lights, four electric motors and a telephone circuit with four or five stations. At the end of the space, which has a frontage of 50 feet, is represented a central light station at which will be located the apparatus for cutting in and out the electric lights and motors. At the other end is placed a stand representing the train dispatcher's office from which the various signals and telegraph stations will be controlled. The instruments and appliances are finely finished and of the standard pattern.

The Griffin Wheel & Foundry Company, Chicago, has so placed its wheels as to demonstrate practically their qualities. The visitor to the Exposition grounds who travels on the electric elevated road will have an opportunity of riding on cars which are furnished with these wheels, the electric elevated road and movable sidewalk, both being fitted with these wheels. A large number of cars in the transportation building are mounted on trucks with this company's wheels. Several sample motor trucks, in the exhibit made by the General Electric Company, are furnished with wheels manufactured by this company.



NORWICH INSULATED WIRE CO'S EXHIBIT.

M. C. Gault & Company, Winona, Minn., show lightning rods and cables. They also show cable in process of manufacture. This cable is composed of eight small cables twisted about a hollow wire centre. Each of the small cables is composed of twelve galvanized steel wires wound around a hollow centre, each small cable being covered with strips of copper as they are wound into the cable. The cable contains 96 of these galvanized steel wires with over six and one half inches in width of copper. The cable, as fast as completed, is wound on a large drum, fitted with an automatic measuring device which sounds an alarm at every 250 feet.

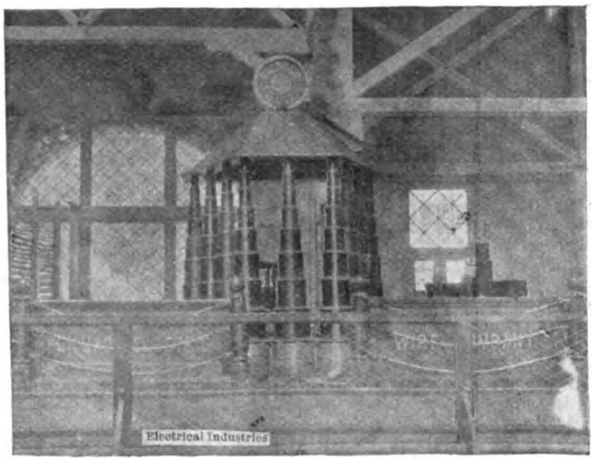
Merrill Bros., Brooklyn, N. Y., exhibit in connection with the Electrical Forging Company a drop hammer by which the metal heated by the electric current is formed into the desired shape.

The Hanson & Van Winkle Company, New York, has secured from the corporation of Birmingham, Eng., the original Woolrych dynamo. It is said to be the first practical dynamo ever constructed for plating. It was constructed in 1844 and was operated for many years at the large silver ware works of Messrs. Prime & Son, Birmingham. In connection with this interesting and valuable relic will be shown the electro-plating machines and other apparatus used at the present time.

The Excelsior Electric Company, New York, has arranged its exhibit, so as to show the arc machines, the arc motors, and the depositing apparatus manufactured by it. The exhibit of its depositing apparatus will especially attract attention on account of its being the latest improvements in this kind of apparatus, and used to such a large extent in copper refineries in this country.

The Belknap Motor Co., Portland Me., has a neatly arranged display of motors in connection with fans of different styles, coffee mills and other small machines.

L. J. Wing & Company have erected a pavilion in which are displayed the various applications of fans for heating, ventilating, for removing steam, dust, etc. Fans will be run by motors directly attached.



CHICAGO ELECTRIC WIRE CO'S EXHIBIT.

Mr. Gilmer Crowell, Brooklyn, N. Y., exhibits his rotary air pump, as it is used in the manufacture of incandescent lamp bulbs. This blower is used in the manufacture of different articles in which a blower is required, but its use, as above mentioned, will be of special interest in this department.

The Illinois Alloy Company, Chicago, Ill., displays a full line of different grades of metals and alloys for journal boxes and journal box linings including bronze casting for dynamo armature bearings, bronze and white brass shells for all classes of motors.

The Reliance Gauge Company, Cleveland, O., is represented at the World's Fair by a neat display of Reliance safety water columns of all sizes, from those for the smallest house heating boiler to the largest vertical boiler. They are finished in japan, polished brass and nickel plate, so arranged as to make a neat appearance. This, however, is only a small part of the company's exhibit. Twenty-one boilers in the power plant of Machinery Hall are fitted with the Reliance columns.

The Billings & Spencer Company, Hartford, Conn., shows samples of commutator bars of copper and bronze for all kinds of motors and generators, also forgings of eye bolts, commutator nuts and rings, wrenches, etc., arranged on a pyramid of polished wood.

The Standard Underground Cable Company, Pittsburgh, has constructed models showing its underground system as well as the method of joining the underground with the overhead systems, all parts of which are shown in detail. A full line of cables and wires of the different styles and kinds manufactured by this company are exhibited.

The Gamewell Fire Alarm Telegraph Company, Chicago, has arranged one of its fire alarm systems, in which it shows not only the operation of the system, but the different styles of apparatus used.

Mr. T. J. Murphy, New York, exhibits in connection with the Weston Electrical Instrument Company a handsome slate switchboard in imitation of oak wood with a shelf of slate in imitation of Mexican onyx.

The K. A. P. Electrical Novelty Company, La Crosse, Wis., has a unique display, a part of which is a globe representing the earth on which are marked the different countries, with a circle of incandescent lights surrounding it. This globe is turned by a belt, on which is a row of incandescent lights which burn constantly. A patent ventilating fan designed for keeping the armature of the generator cool, an electric hair curler, and cautery apparatus are also shown.

The Weston Electrical Instrument Company, Newark, N. J., has been delayed in the preparation of its exhibits, but expects to have a full line of its electrical measuring instruments and appliances on exhibition in the course of a couple of weeks.

Mr. C. E. Lee, Chicago, Ill., displays a number of useful appliances including a battery test, designed for testing the conditions of primary batteries; an automatic battery cut out for opening automatically the circuit of primary batteries when accidentally left closed, preventing the polarization and weakening of the battery; an annunciator, the special feature of which is the use of one magnet for the operation of an unlimited number of calls, also a temperature regulator consisting of a thermostat, designed to be placed in an apartment by which on the temperature rising above a given point the furnace is regulated.

Queen & Company Philadelphia, Pa., display 150 or more different kinds of electrical measuring instruments of their own manufacture. A special pavilion has been erected in which are shown on a switch board its ammeters and voltmeters in operation. A special room has been arranged for their photometer and new arc lamp for projections. Many of these instruments have been especially designed for this exhibit, and it will be most complete as showing nearly every kind of electrical measuring instrument used at the present day by electrical engineers, and at colleges or technical schools for the demonstration of the various principles and effects of electricity.

Mr. George Cutter, Chicago, Ill., has arranged a display including heating devices and electrical rheostats made with resistances enameled on tubes, some of which will be shown in operation, the various kinds of china goods, together with wires, cables, and electrical apparatus and appliances of different kinds.

The Carpenter Enamel Rheostat Company, Bridgeport, Conn., has arranged its rheostats with the exhibit of the Weston Electrical Instrument Company, consisting of four field rheostats for 60 kilowatt dynamos. Besides this a number of rheostats are used in connection with traveling cranes, electric hoists, and also in connection with a number of other exhibits.

The Roessler & Hasslacher Chemical Company, New York, makes an exhibit of chemicals and insulating paint neatly arranged in a large case.

The Western Electric Company has one of the most elaborate and attractive exhibits, occupying some 9,000 square feet of space. Its exhibit has been arranged in different departments. In the large pavilion, designed after an Egyptian temple, are displayed much of the smaller instruments and apparatus. The design of this temple and the arrangement of the lights by which it is lighted produce a very fine effect. The lights in the ceiling are concealed above the colored glass ceiling, and are operated so as to constantly change the light. The cases in the sides of the rooms are lighted from concealed lights placed above them. In these cases are shown the different kinds and styles of telegraphic instruments, testing instruments, also samples of work showing the different designs of the stamping machines as well as a large number of smaller articles and apparatus manufactured by the company. The next pavilion in size is that in which the various kinds of apparatus used in theatre lighting will be displayed, containing a complete stage on which will be shown the method of operating the apparatus, in front of which is a place for visitors and spectators. The space about these pavilions is occupied by exhibits of different kinds. Between the two are shown switch boards on which are placed the various instruments used for connecting and controlling generators. In another booth is shown a number of complicated machines for the manufacture of different instruments and apparatus including a braiding machine, a multiple drill, etc. Generators and motors of between 30 and 40 different styles are shown. The speaking tube manufactured by the company is also displayed in an arch of neat design. The police telephone and signal system is shown, also the different kinds of telephone apparatus manufactured, besides all kinds of its insulated wires and cables including large telephone cables with paper insulation.

The Union Electric Company, New York, shows in operation a number of storage batteries of different sizes operating different pieces of machinery. The batteries are charged from a generator run by a motor in the exhibit, so that all operations connected with the use of the storage battery are illustrated. A new style of underground conduit is also shown manufactured by this company.

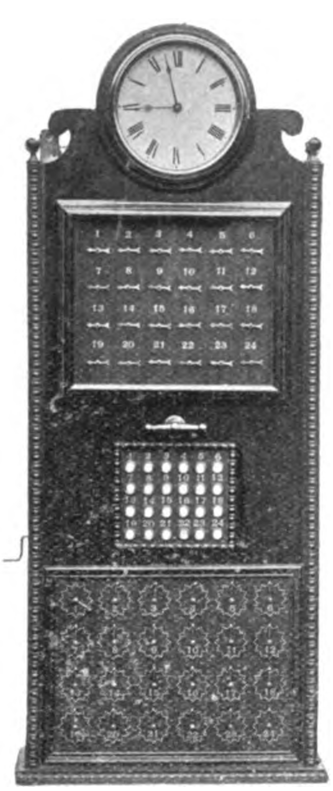
Taylor, Goodhue & Ames, Chicago, occupy a space on the ground floor of about 600 square feet. Wagner alternating and direct current power motors and generators, Burton Electric heaters for street cars, offices and residences, also Burton electric cooking utensils, Century insulated wires, cables and tapes; Acme oil filters, together with station switches, annunciators, push buttons and bells, etc., will be neatly arranged for exhibition.

The Electric Appliance Company, Chicago, is arranging its display on the west gallery of the building. It will include electrical appliances of every description used for central stations, hotels, and the house; also wires, cables and various porcelain specialties and sockets. The exhibit is marked by some large and handsome signs.

The Electro Medical Battery Company, Kalamazoo, Mich., make a display of medical batteries, also Dr. G. M. Webb, Dr. G. Meeker and Dr. A. Owen, who has secured over 1,000 feet of space, on which he has erected a pavilion for the display of batteries and machinery for the manufacture of appliances.

H. W. Johns Manufacturing Company, New York, has a very neat and tasteful display consisting of vulcabeston, moulded mica, Monarch asbestos and other insulating compounds exhibited in the great variety of forms in which they are manufactured. In handsome cases are shown the material illustrating the different steps in its manufacture together with samples of the raw material. The space which they occupy is marked by attractive posts and railings, and in the center is a booth fitted as a private office. The application of the different materials manufactured by this company and shown in this exhibit will attract a considerable attention.

Mr. E. M. Edgerton, Chicago, has an exhibit which will be of special interest to hotel people. It consists of a clock combined with a return call, annunciator and guest call. It is arranged so as to show its operation. It will automatically call any number of guests at any number of different times without the use of a call boy. In the illustration the upper portion represents a clock and return call annunciator. The lower section represents a guest call with indexes. These indexes are in star form, having 12 points corresponding with the hours upon the dial of a clock. Each of the 12 points has three dots corresponding to the quarter hours. An index is provided for each room in the hotel, and each room with a call bell and push button. Thus when the index corresponding to a given room is set at a certain hour, by an electrical contact made by the clock when it reaches a given hour, the call bell in the room rings and continues to ring until the guest arises and pushes the button by which the circuit is broken. The index may be set to call any number of guests at the same time or at different times by which arrangement the clerk is relieved of all trouble in remembering the call and avoids any mistakes caused by change of clerks, etc.



The Eco Magneto Clock Company, Boston, exhibits in connection with the Electrical Forging Company two of its watchmen's clocks; one a simple recorder made to illustrate the working of the system, the other a recorder in case with Seth Thomas clock regulator.

The Todd, Applegate Company, Chicago, will exhibit a system recently patented. It is used to record at intervals the temperature and also water and steam pressure. As a temperature recorder it will be of great importance to shippers of dressed beef, fruit and vegetables in cold storage. It is also adapted for use in warehouses, elevators, etc. It is called the telemeter and is about 8 inches square enclosed in a substantial box. This instrument will print an accurate record every half hour or every hour of the temperature. It is printed on paper tape which can be detached and filed with the bill of lading when the car reaches its destination. It will thus detect any want of care or attention on the part of the carriers during the transportation of the goods

World's Fair Electric Light Station.

The power plant in Machinery Hall will be one of the most attractive and interesting features of the Columbian Exposition. The Westinghouse incandescent plant, which is the largest and occupies the central portion of the power plant, will receive the greatest attention. It is undoubtedly the largest incandescent station ever installed, and contains some of the largest apparatus ever constructed. The large engines that it contains are the best and latest designs built by several of the representative American manufacturers.

The dynamos in the incandescent plant are those furnished by the Westinghouse Company under their contract with the Exposition to furnish all the incandescent lighting for the grounds and buildings. There are twelve alternating current 2,000-volt dynamos, each of a normal working capacity of ten thousand 16-candle power incandescent lights, and capable of a maximum of fifty per cent. more than than this amount. Six of these machines are directly connected to Westinghouse vertical tandem compound 1,000-horse power engines, and the other six machines are belt driven from horizontal engines of various makes. There are also two 4,000-light dynamos which are belt driven by two Westinghouse compound engines of the ordinary type. These latter were set some months ago for temporary service, and will remain during the Exposition.

The main attraction of this great plant will be the great Allis two thousand-horse power engine the giant of the plant, which drives from its thirty foot fly wheel two of the belt driven dynamos. The dynamos are set in tandem and the belts, which are seventy-two inches wide, run one over the other at the rate of over a mile a minute. The Allis engine is located under the central dome of the south nave of Machinery hall, and on an elevated platform which was necessitated by the size of the foundation. South of the Allis engine, and occupying the same block, is the Fraser and Chalmers engine driving one dynamo. Between these two engines are placed the 400-horse power engines and dynamos.

The Allis engine is a quadruple expansion, the largest cylinder being large enough for a tall man to stand upright or lie down inside. The Fraser and Chalmers is a four-cylinder triple expansion engine.

In a gallery against the south wall of Machinery hall, immediately adjacent to the Fraser and Chalmers engine is the Westinghouse switchboard. This is a double board about 80 feet long, and entirely of marble. There are not less than 210 cables leading from the board. It is the largest switchboard ever erected, and forms an imposing background for the great engines.

The other engines and dynamos lie to the west of the main block. There is a block containing the four direct connected Westinghouse engines, then the three other belt-driven dynamos. The engines driving these are a Buckeye, an Atlas, and a McIntosh and Seymour. The Buckeye is a four-cylinder triple expansion, and the others are tandem compounds. West of these is a small block containing the remaining two direct connected machines which complete the plant.

Most of the incandescent plant will be ready to operate May first, and the remainder will be complete in every particular a few days later.

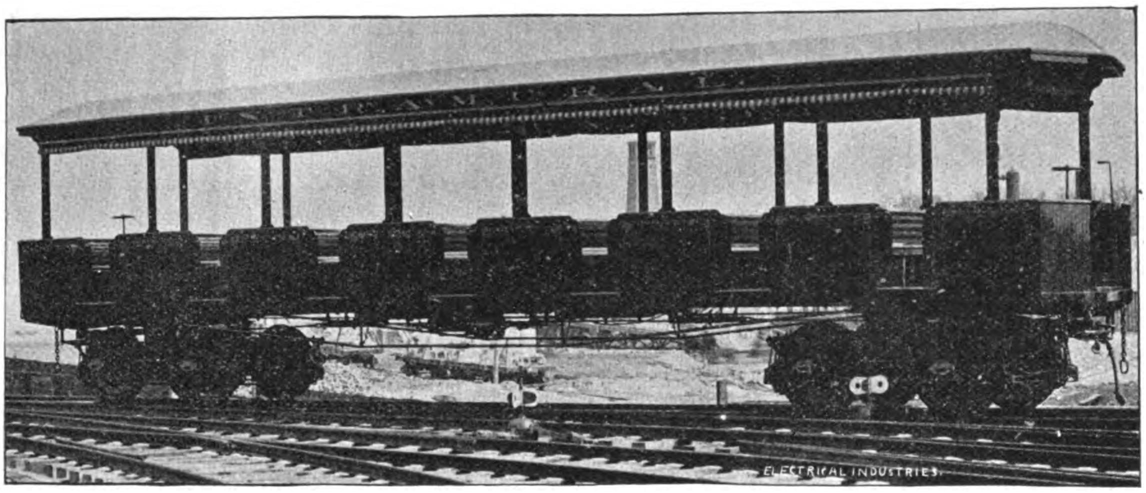
The Columbian Intramural Railway.

Early in the history of the World's Columbian Exposition the subject of intramural rapid transit was considered and a large number of plans were received by the managers for accomplishing the desired end. The present system which is now practically completed, was adopted by the authorities on account of the many features specially adapting it for the use for which it has been constructed. While it has been built for the transportation of passengers about the grounds, every part of its construction, and every feature connected with the working of the system has been so made and arranged as to give the visitor an opportunity to see and investigate the manner and method of running as well as its construction.

As it is the first electric elevated railway in this country, it will be closely examined especially by persons interested in rapid transit, and no part of the electric exhibit will be of greater interest to electrical and railway people. It has a model power house designed to accommodate a large number of visitors, and fitted to test different kinds and styles of apparatus. Its rolling stock although specially designed for World's Fair traffic, is fitted with the latest styles of motors, trucks, air brakes, etc.

Early in January, 1892 bids were asked for, for the construction of the road, and some time later the contract for constructing and operating an intramural electric elevated railway was awarded to the Western Dummy Railway Company, of Chicago. This company, under an excellent manager and with the aid of an experienced corps of engineers, commenced work immediately, and has pushed the work through to a successful completion. In July last a contract was let to Remington & Company, of Chicago, for the construction of the road. The foundations are of concrete, except in the lower part of the grounds, where timber foundations have been put in covering a larger area than the concrete. On these foundations rest the timber bents which support the steel I beams carrying the ties and rails. These bents vary from 12 to 30 feet high and their construction was changed according as it was necessary to give greater strength to the longer bents. These bents average about 25 feet apart. The steel I beams and rails were furnished by the Chicago Steel Company. The work has been carried on under the supervision of Mr. C. P. Matlock, chief engineer; Mr. C. H. Macloskie, electrical engineer, and Messrs. R. I. Sloan and G. K. Wheeler were retained as consulting engineers. The station platforms are constructed on the same general plan as those of the New York and Chicago "L" roads.

The road encircles the grounds except about one-half mile in front of the Government and Manufacturers buildings. It is double-tracked its entire length. The north loop is over the lagoon at the northeastern corner of the Government building, from which point the road runs north around the Fisheries building past the Swedish exhibit, and between the eart art gallery annex and the exhibit of France and the city of Paris to the north boundary of the grounds, along which it turns until it reaches the fence along Stoney Island Avenue, where it circles around the Esquimau village and runs along the west fence till it passes the Sixty-second street entrance, then it runs toward and over the Transportation building to the central terminal station, where it has excellent facilities for receiving and unloading passengers, from there it runs around the Machinery Hall annex along its south side, passing between the Agriculture annex and the Stock Pavillion, and thence runs in a southeastly direction until it reaches the Anthropological building, around which it circles and runs northwesterly along the Forestry building and the Krupp exhibit and loops around the Indian School. Owing to the uniformity of the grounds there are no heavy grades, two per cent being the maximum. The curves vary from a 100 foot radius at the loops to 2,000 feet.

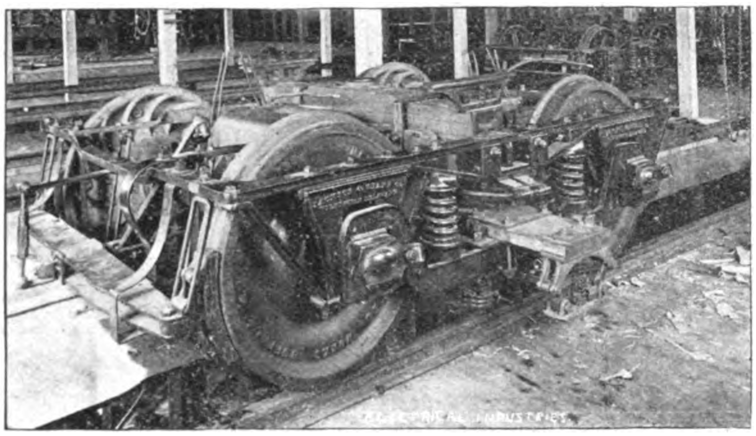


COLUMBIAN INTRAMURAL RAILWAY CAR.

The cars and trucks were built by the Jackson & Sharp Company, of Wilmington, Del. They are nicely finished and substantially built, and are fitted with the New York air brake. The doors reach only as high as the backs of the seats, giving every opportunity for sight seeing. At the end on each side of every car is a lever which opens and closes all the doors on that side, allowing the passengers to pass out and in quickly, thus making the stops at the stations as short as possible. The cars are furnished with curtains to shut out the sun or rain when desired. They are lighted by incandescent lights in such a way as to make them attractive at night. The trains will consist of a motor car with from two to four trailers as the traffic demands. Each motor car is equipped with four motors which have a maximum capacity of 125-horse power, although normally rated at 50-horse power. The current is transmitted over a third rail, a 60-pound rail like the others laid about 18 inches on the outside, from which connection is made to the motor by a sliding shoe suspended from a bracket on the side of the trucks. The return current is carried by the rails of the track and the I beams that sup-

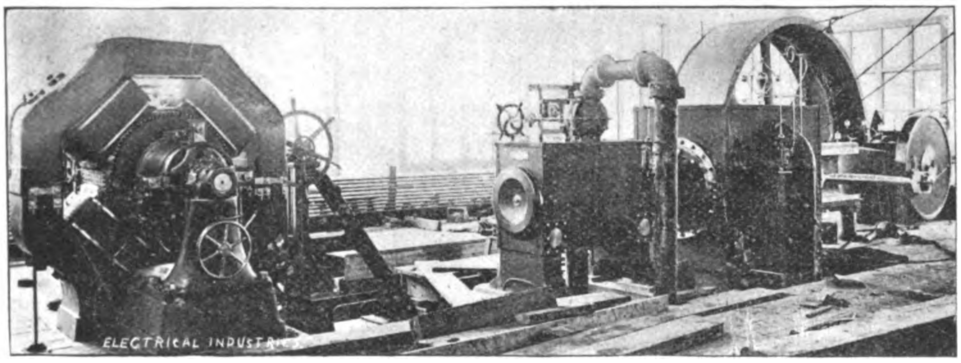
port the ties, to which the rails are connected by copper wires and carried to the switch board. The rails of the conductor are fastened together by copper strips riveted through the fish bolt holes, no fish plates being used.

The entire road is equipped with the Rowell-Potter Safety Stop Company's block signal system. This system has not only the visual signals but also an automatic device for throwing on the air brakes should a train leave one block before the next block is clear. Every precaution has been taken in the construction of the road to guard against accident.



COLUMBIAN INTRAMURAL RAILWAY—CAR TRUCK.

The power house designed by Mr. B. J. Arnold and under whose supervision it has been constructed and equipped, is situated in the extreme southeastern part of the grounds beyond the Anthropological exhibit, about 300 feet from Lake Michigan and about two hundred feet from the main oil tanks, which supply the exposition company with fuel. Its situation was well chosen, being near its water and fuel supply. The foundations for the engines and generators, although required for only a few months, are necessarily of a very substantial character owing to the weight of the machines. They were built by Cassidy & Victor, of Cincinnati. The tops of the foundations are level with the floor of the second story, which is about ten feet above the ground, allowing visitors to go beneath the machines and inspect the foundations, steam pipes, condensers, etc.



COLUMBIAN INTRAMURAL RAILWAY—GENERATOR AND ENGINE.

Entering the engine and dynamo room at the northwest entrance a 20 by 38 by 48 tandem compound Green engine confronts the visitor, connected by a 48-inch belt, manufactured by the Page Belting Company, Concord, N. H., to a 500 K. W. multipolar generator of the T. H. type. The engine is built by the Providence Steam Engine Company, of Providence, R. I., and will develop from 750 to 1,000-horse power. The belt is supplied by a tightening pulley made by the Eclipse Clutch Works of Beloit, Wis. Next to this stands a 13 by 23 by 22 McIntosh & Seymour tandem compound engine coupled direct to a 200 K. W. generator. This engine runs at 150 revolutions per minute and will develop from 300 to 400-horse power. Beyond this in the center of the building stands a 32 by 42 by 62 cross compound Reynold's corliss engine, built by the E. P. Allis Co., Milwaukee, Wis. It is coupled direct to a 1,500 K.W. multipolar generator, which is the largest generator yet constructed. The main shaft is two feet in diameter, 30 feet long and weighs 55 tons. The armature is 14 feet in diameter. This combined machine runs at 80 revolutions per minute and will develop from 1500 to 2500 horse power. Toward the east end is a 22 by 44 by 36 cross compound Hammond-Williams vertical engine, built by the Lake Erie Engineering Works, of Buffalo, N. Y., and coupled direct to a 500 K. W. multipolar generator, and at the extreme east end of the room is a 22 by 42 by 48 Reynold's tandem compound corliss engine coupled to the shaft of which is a 500 K. W. multipolar generator. This machine is designed to run at 80 revolutions per minute. All the engines are run condensing. Connected to the Allis engines are two vertical Allis jet condensers and air pump; to the Hammond-Williams engine is connected a Conover jet condenser and air pump, built by the Conover Manufacturing Co., New York; to the Green engine a Worthington duplex jet condenser manufactured by H. R. Worthington, of New York, and to the McIntosh & Seymour engine a single acting condenser built by the Dean Steam Pump Co., Holyoke, Mass. The water for condensing purposes comes from the lake through a pipe laid at such a descending grade as to allow the water to flow freely, while above this is a sewer pipe with grade descending toward the lake. The water flows by gravity to the power house, where it is raised by the condensers to the upper pipe where it flows by gravity back to the lake.

All the generators in the power plant as well as the car motors were built by the General Electric Company at its shops at Schenectady, N. Y., and Lynn, Mass., and are the the latest styles of machines. In the center of the north side of the room raised several feet from the floor is the switchboard surrounded by a platform which is high enough to allow visitors to pass beneath it. This platform is fitted for the superintendent of the plant, and from this elevated position he is able to keep every part of the entire plant under his direct supervision, and by means of the electric bells and speaking tubes, which connect the switch board with the different generators, engines and boilers, he is able to direct the working of the entire plant. The boiler plant, which is also in plain view of the switch board platform, consists of ten Babcock & Wilcox water tube boilers. They have a combined capacity of 3000-horse power, but are capable of developing 5000-horse power. One Gould Manufacturing Company's triplex boiler feed pump, and one Smith-Vaile duplex boiler feed pump, also intended for fire purposes, keep the boilers supplied with water. The water is first forced through the Green feed economizers furnished by the Fuel Economizer Co., of Matteawan, N. Y., of which there are two batteries. The smoke connections are made so that the draft may be turned through these economizers or direct to the stack as desired. Two of the furnaces have been fitted to burn coal while the balance are fitted with oil burners of several patterns put in by the National Supply Co., Chicago. The oil burners are supplied from the exposition company's supply tanks through two-inch pipes, the oil being forced into the burners by pumps at a pressure of about five pounds to the square inch.

J. H. Rhotehamel, President of the Columbia Incandescent Lamp Co,, St. Louis.

Mr. J. H. Rhotehamel, the subject of this sketch, was born October 20th, 1857, on a farm in Miami County, O. His early education was acquired in a country school, after which time he attended Antioch college of the same state, not completing, however, the full course. After leaving school he engaged in teaching, and then went into the real estate and investment business. On leaving Ohio he spent a few years in Chicago, going to St. Louis in 1889 and organizing the present Columbia Incandescent Lamp Company, whose prosperous business has depended almost entirely upon his individual efforts. He is entirely self made, having pushed his way in the world unassisted.

The name of Mr. Rhotehamel is familiar to everyone at present in the electrical business from the important case just won by him for his company in the suit brought against it by the General Electric Company for injunction restraining it from the manufacture and sale of incandescent lamps. Too much credit cannot be given him for the able manner in which he has conducted the fight against the General company almost single handed and alone.

The history of this case is well known to most of our readers. It was but a short time after the Columbian Incandescent Lamp Company had had suit brought against it by the Edison Light and Edison General companies that Mr. Rhotehamel made a personal investigation of the Goebel case and was thoroughly convinced of the genuineness and truth of the matter. He then made preparations to use the same defense in the case of his own company. He was surprised but lost no confidence in the genuineness of the defense when the decision by Judge Colt was rendered in favor of the General company. Many, indeed it may be said the concensus of opinion in electrical circles was that it would be useless for him to present this defense further, but he advised his company to make it, and after presenting the facts to Mr. C. C. Fowler and Judge E. B. Adams of St. Louis, proceeded on their advice to prepare a defense with the result as shown in the case just tried.

Mr. Rhotehamel's confidence and persistency won the battle. The same good judgment which had marked his career in the past and enabled him to surmount the greatest difficulties has been amply shown in the present case. He deserves the greatest credit, and we join with his friends in extending to him and the company he represents our most hearty congratulations.

Electric Vehicles.

BY ROBERT L. ARDREY.

There are indications that vehicles carrying two and four passengers will be successfully propelled by electric storage batteries over the boulevards and streets of Chicago the coming summer. For two or three years past reports have been frequent of pioneer efforts to build vehicles of this class, but nothing has yet materialized that could be called a successful or practical invention, and the best that any one inventor has been able to do has been to bring out some device that may find a place in the successful electric vehicle of the future.

Electrical Industries.

MR. J. H. RHOTEHAMEL.

Last summer, a Des Moines man came to Chicago and exhibited on the streets an awkward, unpromising, carry-all kind of a vehicle, with seats for six or eight people. It was able to run at a speed as high as eight and ten miles an hour. The storage battery was a distinct advance over the standard, lead plate type.

In the design of running gear suitable for such a vehicle, a west side Chicago bicycle inventor brought out, last summer, what may prove the foundation for future development, and had he not been led astray by the "primary battery" delusion success might have crowned his efforts. His wheels were of pneumatic tired bicycle pattern, and the gear of steel tubing. We venture that cushion tires will be found better adapted, and in fact learn that the inventor intends substituting them for the pneumatic. Stopping to pump up air may be a pleasing diversion to the bicycle rider, but with a four wheeled vehicle it would occur too often, to say nothing of the greater risk of punctures.

There are at least two practical electricians in Chicago working on the electric vehicle problem. One of them has already built an experimental phaeton, and is at work on an improved style which he thinks will have a speed of eight miles an hour for four or five hours. These, with two other inventors of limited electrical experience, working independently, may be able among them to hit upon the combination of devices necessary in a vehicle that can without risk of breaking down, run eight or ten miles for an afternoon, and thus afford to the hedged in city man and his family the pleasure of a ride on the boulevards, without the expense and bother of keeping a horse, or the exertion and *abandon* of bicycle riding.

This is a promising field for electrical men, and they should not overlook it. In the city of Chicago alone many thousands of electric wheels could be put into service, provided the cost of rental was made low enough to be within reach of the man of moderate means.

Annual Report of the American Bell Telephone Co.

The American Bell Telephone Co., issued last month its thirteenth annual report for the year ending December 31, 1892, of which the following is an abstract. Regarding the increase of business during the year 1892 only one of the previous eight years shows so large a gain in the number of exchange stations, and the number of subscribers has not only increased but the average daily use of the local exchange service has also increased, being 10 per cent greater than in 1891. The computed total number of exchange connections yearly throughout the United States has advanced from 312,605,000 in 1886, to 600,000,000 in 1892.

The report mentions the work performed during the year of connecting the territories of the different licenses; the construction of the long distance line connecting New York with Chicago with spurs to Boston, to Detroit and Milwaukee; the perfection of the system so that one can talk from a station in any of the principal cities to any other within the territory between Concord, N. H., New York, Washington, D. C. and Chicago. In constructing these lines, in building plants to meet the growing business, and in bringing existing plants up to the level of our present knowledge, and in yielding to the public demand in the more thickly settled portions of the large cities, that the wires go underground, in these various branches of work from 1885 to 1892 there has been expended, after ample allowance made for repairs, no less a sum than $35,737,049.14.

In the last annual report it was stated that the long pending application of Berliner for the microphone, had been allowed by the commissioners of patents bearing date Nov. 21st, 1891. This year it is reported that Edison's application for a patent for the carbon telephone has been granted to the Western Union Telegraph Co., as assigner of Edison and will be controlled by this company under its agreement with the Western Union Telegraph Co.

The expiration on March 7th, 1893, of United States patent No. 174,465 issued to Prof. Bell, occasioned some confusion in the public mind, owing to the fact it was not clearly understood that Prof. Bell's patents were two in number, the second of which, No. 186,787 dated Jan. 30th, 1877, will continue in force until Jan. 30th, 1894.

Then followed a statement concerning the Blake transmitter, the case of the United States vs. The American Bell Telephone Co. and Alexander G. Bell and the suit instituted by Attorney General Miller to annul the Berliner patent.

The Construction of Street Cars.

In the construction of street railway cars it is desirable to employ the least amount of material, which will give the strength required in the work for which it is intended. Any superfluous weight has not only its effect on the motive power, but on the roadbed as well and consequently makes a difference in the dividends at the end of the year.

A recent article by John C. Henry, contains some very valuable matter on this subject, in which he says in substance: the omnibus is constructed to shelter passengers and stand the vibrations incident to a rough road. They are built as commodious and light as possible. Sleeping cars are built to stand a high speed, to roll over embankments without breaking to pieces and to stand the kicks and jerks of a 1,000 horse power engine. The modern electric car is a cross between the two. In the construction of the street cars which are required to stop and start frequently, to lift themselves up steep grades, I think the lines of the omnibus should be observed more particularly in the roof. If it is light, the walls and sides may also be. The city of San Francisco leads the way in mechanical street car traction. Their cars are admirably adapted for electric motors and are known as combinations. The earlier built were remodeled horse cars. The managers took the ordinary 14 foot horse cars, removed the platform and hood from one end and built a light 14 foot addition thereto. The new part was open with a passageway down the center and the seats placed lengthwise, the passengers facing outward; these car bodies weigh about 7,000 lbs. and are mounted on light double 26 inch trucks. When mounted they weigh from 10,000 to 11,000 lbs. Their weight is distributed on eight wheels; taking the maximum estimate of their weight makes the weight on each wheel but 1,375 lbs. By adding a 30 horse power motor and placing it on the forward trucks would give a pressure on the rail not to exceed 1,700 lbs. per wheel.

There are in many places to day four wheel electric street cars that weigh empty not less than 10 tons with a wheel pressure of 5,000 pounds or almost twice that of a standard freight car. According to a law in mechanics this four wheel car injures the track seven times as much as the San Francisco style of car with motor. When the rolling stock is properly designed and the joint ties are supported on concrete, a 35 pound girder or T rail is all that is necessary for ordinary street railway purposes.

The combination car has nearly double the carrying capacity of the four wheeler referred to and weighs nearly three and one half tons less. If the estimate is correct that it costs two cents per ton per mile to move this superfluous weight and the mileage is but 100 per day there would be a direct saving of seven dollars per day, which multiplied by the number of cars and the average number of day runs for a year would make a large amount, representing the difference in the earnings of the road with the two styles of cars.

Electrical Industries.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

Electrical Industries extends a most hearty and cordial invitation to each and everyone of its friends to visit us during the World's Fair. We have plenty of room at our offices in the Monadnock building, located in the very central part of the city and trust you will not delay in letting us know at once of your arrival. We invite you to make our offices your headquarters while you stay as we shall have a place for you to write letters or meet your friends. It will be a pleasure to give you any information in regard to the Fair or the location of electrical people in the city. At our pavilion also in section Y 28 in the Electricity building, we shall hope to have you call early and often.

The executive committee of the National Electric Light Association at a recent meeting at its office in New York city, decided that there should be no meeting of the association the coming summer.

Too much praise cannot be given to Chief J. P. Barrett and his able assistant J. Allan Hornsby, of the Department of Electricity, together with Frederick Sargent, and R. H. Pierce, of the engineering department of the World's Fair, for their able and efficient work in making the electrical features of the World's Columbian Exposition a credit to the electrical industries.

The necessity of taking every precaution to guard against fire in central stations and power houses is brought forcibly to mind by two recent fires, in each of which the loss reached nearly $100,000—the fire at the Orange Electric Railway Company's barns at Roseville, N. J., on April 3, and the fire which destroyed the plant of the McKeesport Electric Company, at McKeesport, Pa.

We are pleased to announce the addition to our staff of Mr. H. A. Foster, who is widely known among the electrical fraternity through his recent connection with the electrical department of the U. S. census, having been engaged as a special agent. This experience, together with his long practical experience in electrical engineering eminently fit him for the work to which he will be assigned in connection with this journal.

The World's Fair Congress, to be held at the Art Institute building, Chicago, during the coming summer will be undoubtedly very instructive. Our readers in planning their visit to the World's Fair should arrange, if possible, their visit so as to attend this assembly.

OPENING THE WORLD'S FAIR.

With the beginning of the present month opens the greatest and grandest exposition the world has ever seen. Our brief account of this opening, found on another page. will, we are sure, be of unusual interest to our readers, The electrical features of the Exposition will be of the highest educational advantage to the public at large by showing the various uses to which the electric current, that has become such an important factor in every day life, has been applied. It will be of interest to the scholar as illustrating by one of the greatest of civilizing agencies the important part great inventions and devices have taken in the making of history. To the scientist it will bring before him for comparison and arrangement the various facts connected with electricity. It will be of interest to the business man by bringing to his attention the various products and applications of this energy. To the manufacturer it will show to what extent it has been adopted in manufacturing establishments, and enable him to intelligently select and adopt in his future improvements the latest and the best devices. In fact, this will be a great school in which all will learn and few will be able to fully comprehend.

THE COLUMBIA LAMP DECISION.

The recent decision by Judge Hallett in the application of the General Electric Company for an injunction against the Columbia Incandescent Lamp Company was without doubt a great surprise to the electrical fraternity. The series of decisions in favor of the Edison interests had lead many to believe that Judge Hallett would render an opinion similar to that recently handed down by Judge Colt. In this matter, however, all prophecies failed. The new evidence brought forward was overwhelming and as it stands today the lamp situation has very materially changed since our last issue. The opinion rendered, however, from a strictly legal standpoint is not settled if the General company desires to bring it to a final hearing. This final hearing, however, could not be brought to an end under a year or more during which time the life of the Edison patent will, in all probability, have expired. Whether or not the owners of the patent will attempt to do this remains to be seen.

Reports from the other western companies which have not been enjoined are that they will proceed to push the sale of lamps and the concensus of opinion of all whom we have interviewed seems to be that the monopoly of the incandescent lamp business has passed out for ever from the hands of the General company. Another phase of the question presents itself. As it now stands the enjoined companies can ask the court which granted the injunction to vacate that injunction on the ground that new evidence has arisen. In the east it is to be presumed if the case were to be brought before other judges that it would be decided in accordance with the opinion of Judge Colt. In the west, however, we believe the opinion of Judge Hallett will be followed in case the matter is brought up in that district.

On the whole judging from the number of new lamps already in the market it will make very little difference to the consumer whether the Edison patent stands on a final hearing or not. Within the next month there will also, we predict, be a still greater number of new lamps, a fact which will tend to make the situation less complicated to say the least and very likely benefit the buyer.

Street Railway Franchises.

The value of franchises granted by city councils to individuals or corporations supplying the public with light, heat, water or means of transportation, is often hard to determine. With street railway franchises, where one company is given a monopoly of certain streets, the price cannot be regulated by competition, as in other classes of business and it often happens that a company receives a return out of proportion to the capital invested.

It sometimes happens also that the company, to whom the franchise has been sold, is not able to furnish a respectable service, its income not permitting of any outlay to improve the service after paying running expenses and the city tax, and the public is not in the least benefited by the arrangement. A few days since the city council of Indianapolis offered the franchise of a street railway to the highest bidder. The former holders declined to bid, saying it was impractical. But a bid was received from Judge Elliott, accompanied by a certified check for $25,000, accepting the terms offered and proposing to pay ten per cent of gross receipts for the first five years, 12½ per cent. for the second five years, 13½ per cent. for the third five years and 14½ per cent. for the balance of the period. The board stated they would accept the proposition.

According to the published statement of the old company, its gross receipts were over $900,000 last year. Thus the city will receive $90,000 and upwards a year from this franchise. Whether Judge Elliott succeeds in the enterprise remains to be seen.

Transmission of Power in Factories.

The growth of electricity in its applicatian to the transmission of power in mills, factories, and machine shops has been very rapid. In places where little power is required, if a current can be had from a central station, it is generally used not so much from a point of economy when a steady load is required, as its convenience and neatness. Its superiority over all other forms of transmission when the energy is required to be transmitted a considerable distance is conceded by all; but that it can be used economically in mills and factories in the transmission of power to the various parts of the factory has not until recently been demonstrated.

The Scientific American of April 1st contains a very interesting description of the power plant installed in the new small arms factory at Herstal, Belgium. The work was undertaken under the direction of the Société Internationale d'Electricité for the purpose of comparing this with other modes of transmission. When work was undertaken by the society the engine had already been ordered of 500-horse power, running at 66 revolutions per minute and for this reason a special dynamo had to be constructed. The fly wheel was done away with and in the plan of dynamo adopted the armature acted as a fly wheel. This armature was supplied with two commutators allowing the generator to be run in either full or at half load. In order to compare the efficiency of electrical transmission with other kinds, the most eminent firms were asked for details, as to the power necessary at the engine to deliver a given power to the machines using mechanical transmission, but no satisfactory replies were received. In the factory there was required power to turn 9 shafts requiring 12-horse power each, two shafts requiring 16-horse power each, and two shafts requiring 30-horse power each. The motors that were put in, in order to be fully up to the requirements, were of the following horse power: nine motors of 16-horse power, two motors of 21-horse power, two motors of 37-horse power. The motors were guaranteed to have an efficiency of from 87 to 89 per cent. and the generator an efficiency of 90 per cent. The efficiency of the engine was guarranteed to be 92 per cent. so that the power delivered by the motors was 72½ per cent of the indicated horse power of the engine.

Owing to the absence of all belt transmission, the power necessary to drive the engine idle is but 28-horse power while with another form of transmission it would not be less than 40-horse power. Many of the motors are subjected to a variable load and also are exposed to dust and dirt. By belt driving the power lost in transmission is a constant quantity for all loads. It shows that taking 79.4 per cent as a final output in the two cases one of the electrical and the other of the mechanical transmission we find that at a load of 20 per cent, the electrical system will still give a load of 47.2 per cent useful effect and the mechanical none at all. From careful experiments, which had been made in actual practice, it has been clearly proven that to drive all the machines idle needs more power than to drive the shops in the ordinary course of work; whereas 11 electrical horse power is required in driving all the tools idle only about 7 electrical horse power is used to drive the shafts, belts, etc., alone. This clearly shows how small a part of the power produced by the engine is actually used in useful work at the tools. Such satisfactory results of the application of electricity to factory driving must attract attention and will doubtless lead to great changes in transmission. Whether it is advisable to supply each machine with a separate motor is a question which must be considered in each case. The current can be switched on or off as easily as a belt may be thrown from the loose to the fast pulley.

The General Incandescent Arc Light Company, New York, reports that it has taken the agency for the United States and Canada for the arc light carbon and carbon brushes manufactured by Fabric Electrischer Belauchtungskohlen in Nurnberg, Actiensgesellschaft vornals ch. Schmelzer. This will give the electric lighting public an opportunity to purchase one of the very best grades of imported carbons at prices which compare favorably even with domestic carbons whose good qualities are too well known to need comment.

The Chicago Electric Club.

The annual election of officers of the Chicago Electric Club was held April 20th at which time officers, managers, committees, etc., were chosen for the coming year. The following are the officers elected: President, J. P. Barrett; first vice-president, F. W. Parker; second vice-president, E. Baggot; third vice-president, F. W. Cushing; fourth vice president, George Cutter; secretary, F. L. Perry; treasurer, J. W. Johnson; managers, F. W. Horne, chairman; L. A. Ferguson, S. A. Douglas, M. A. Knapp, J. W. Buckley, E. C. Ferguson, C. T. Page, A. S. Terry, Ben Williams, L. S. Hills membership committee, C. C. Haskins, Thomas G. Grier, D. G. McDougall.

President Barrett announced on assuming the duties of the office that with the assistance of the members of the club its influence could be widely extended during the present year as the club would have an opportunity to entertain many distinguished electricians from various parts of the country, and he felt sure that it could be done very creditably with the co-operation of every member. The president expressed his high appreciation of the compliment shown him by the members in electing him their president.

Works of the National Electric Manufacturing Company.

At Eau Claire, Wis., an enterprising and flourishing town of twenty thousand inhabitants, that owes its origin and early growth to the lumber interests formerly centered there, but more recently to the factories and manufacturing institutions established, is located the shops of the National Electric Manufacturing Company.

These shops occupy a number of buildings which have been erected as the business increased and greater facilities were required to meet the demands of the trade. The building occupied by the machine and armature shops, and the testing and finishing room is 250 by 50 feet, two stories high with high ceilings, giving plenty of light, ventilation and sufficient room for handling the heavy machinery manufactured. The machine shop is 100 by 50 feet employing 75 machinists and the armature shop is of the same size employing 30 men. The testing and finishing room, where every machine and piece of machinery is tested before it leaves the factory, is 100 by 50 feet and fifty men are constantly engaged in this department. In the switchboard department 25 men are engaged in the manufacture of switchboards and switchboard appliances.

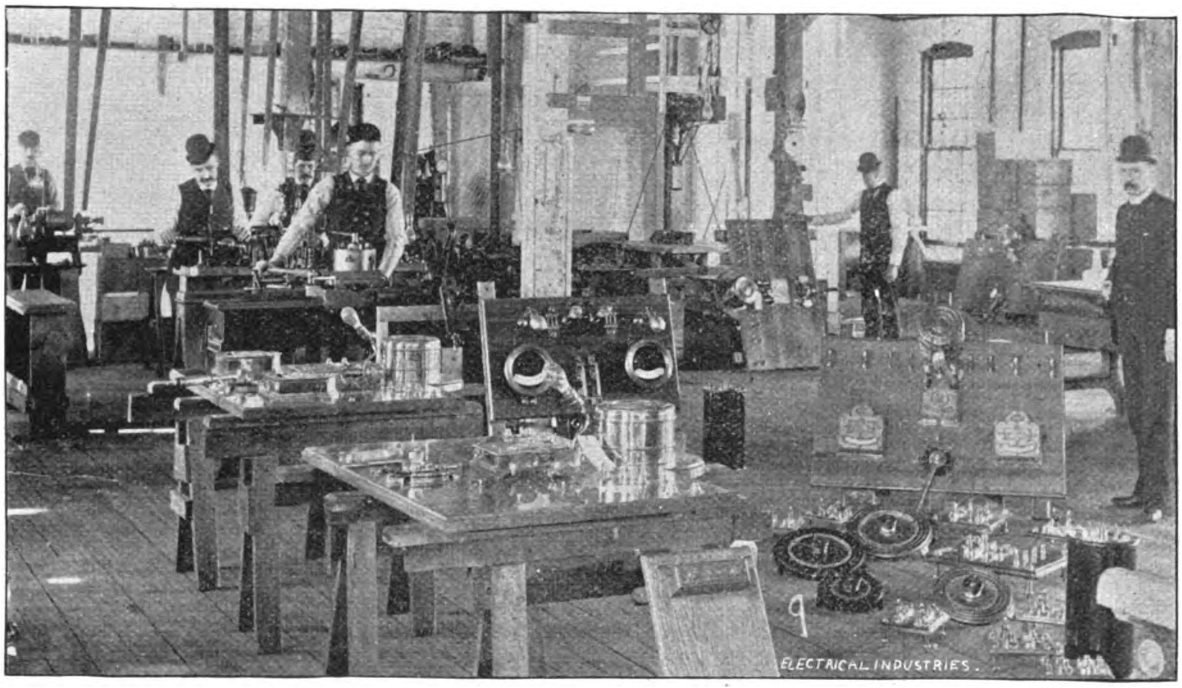


FIG. 1.—NATIONAL ELECTRIC MANUFACTURING COMPANY—SWITCHBOARD DEPARTMENT.

The laboratory and draughting rooms are models of their kind, while the pattern room and in fact, every department of the works is supplied with an abundance of modern apparatus. The boilers and engines are of ample capacity to supply the present needs, having been increased judiciously as more power was required. The system of electric transmission of power has been successfully adopted. A 22 by 42 inch Corless condensing engine, manufactured by the Edw. P. Allis Company of Milwaukee, drives a generator from which the electricity is distributed to motors in different parts of the works. These motors are belted to the shafting from which power is taken as desired for the individual machines. The different departments are furnished with incandescent lights conveniently placed to supply the light required. Hoists and cranes are used and are so placed that for loading, unloading and for conveying heavy machinery about the factory the least amount of physical force is necessary. The accompanying illustrations will give a very good idea of the interior of the shops. Every precaution is taken to guard against fire, electric fire alarms being placed in every department and every employe is drilled as a member of a fire brigade. The stairways have been built wide and the numerous exits provided from the building afford every facility for getting out of the buildings quickly. During the five years, since the establishment of the factory at Eau Claire, no one has been seriously injured in the service of the company, a remarkable record and one that shows the intelligence and skill of the operatives as well as the excellence of the management.

From this factory, through its various offices established in all the large cities of the United States and Canada, are shipped the various goods manufactured, complete isolated lighting plants, stationary motors and apparatus, street railway generators, mining plants and central station apparatus of all kinds for both direct and alternating currents. To the construction of the generator, both for alternating and direct current, which is a most important element in the installation of an electric lighting plant, as upon its faithful and constant performance depends the success of the installation, special attention has been given by the electrical and mechanical engineers of the company, to which the efficiency, the excellence of the mechanical construction and symmetrical appearance of the generators testify.

In the transformer department are made transformers of from one up to 300 light capacity. They are constructed of a circular form, that allows the primary coil to be entirely surrounded by wire which insures a magnetic field in which there is very little loss. The distribution of the iron is such as to allow a most thorough ventilation in the spaces over and under the coils. The two coils after being wound, care being taken to insulate the outside windings of the coils by an extra linen wrapping, are taped and shellaced, then dried in a kiln for 48 hours before being taken to the testing room. Every transformer is severely tested and is not shipped unless it shows a regulation within two per cent. In the testing room the coils are subjected to an insulating test under a current at 3,000 volts and the secondary coil is short circuited several times before the insulation is pronounced perfect.

The coils are then placed in the case, care being taken to insulate perfectly the terminals and to raise the cores sufficiently from the case to give good ventilation to all points. Transformers of capacities between five and fifty lights have the primary terminals fitted with a safety device, that permits the primary coil to be opened and a new fuse inserted without interrupting the rest of the line, the change being made with absolute safety to the wireman. These transformers except the small ones have an efficiency of 97 per cent and are well guaranteed by the company. In addition to the alternating apparatus, direct current generators and appliances are built, in which it has endeavored to combine all the latest and best ideas of modern electrical engineering. The armature in these machines is of the well known Siemens type but wound in a manner peculiar to the products of this shop, by which the difference of potential between any two neighboring coils is cut down to one-half of the total E. M. F. of the dynamo. The fields are plain shunt or compound wound.

Railway generators, dynamos and motors for power plants, particularly those of the multipolar type are becoming a specialty with the company. In these machines the armature core consists of soft sheet iron discs or rings, clamped together between two halves of a phosphor bronze spider or carrier, and instead of a series of bolts passing through the iron core, these rings are held together by fingerlike extensions of the spider, whereby all injurious eddy currents in the core, caused by bolts passing through it, are avoided.

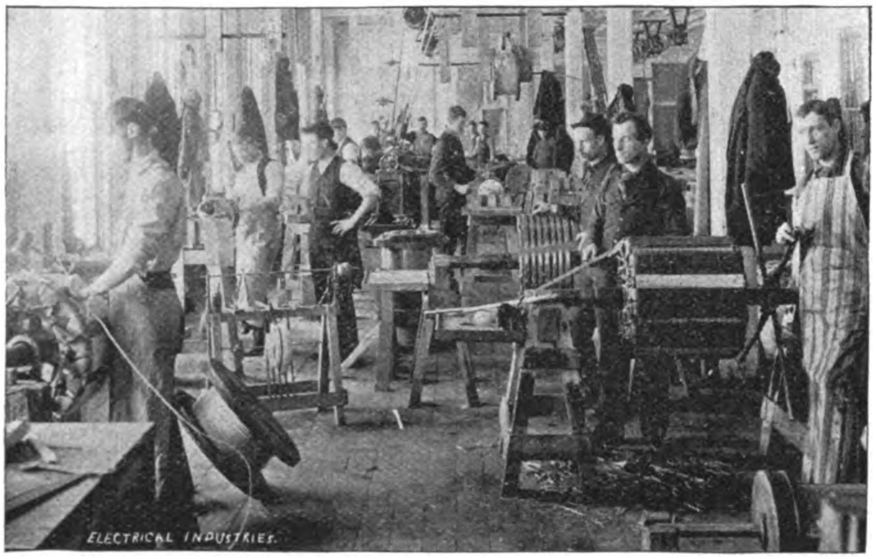


FIG. 2.—NATIONAL ELECTRIC MANUFACTURING COMPANY—ARMATURE DEPARTMENT.

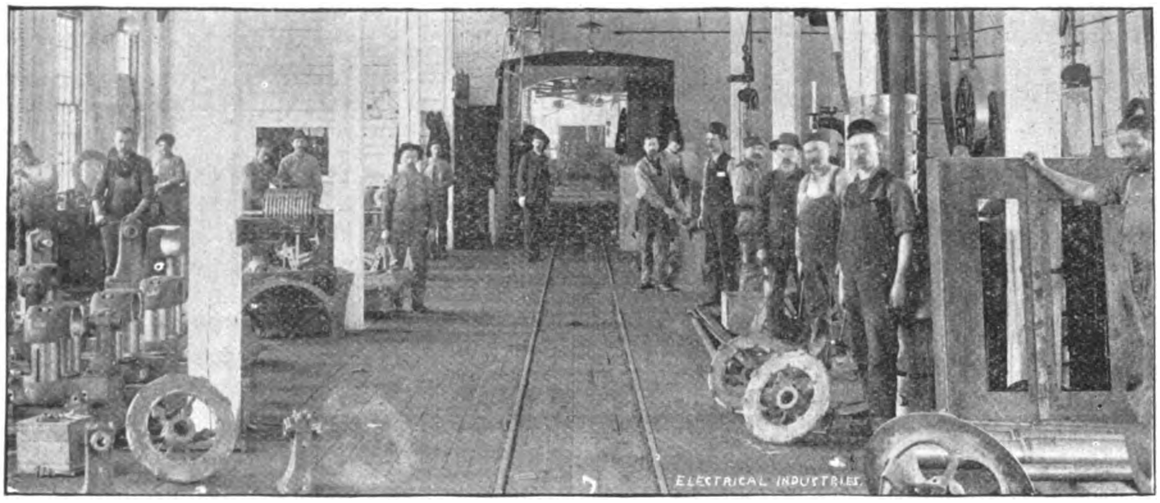


FIG. 3.—NATIONAL ELECTRIC MANUFACTURING COMPANY—ASSEMBLING AND TESTING ROOM.

The officers of the company are as follows: Mr. Fitch Gilbert of the Eau Claire Lumber Company, president; Mr Morgan Brooks, of the Electrical Engineering & Supply Company, St. Paul, vice-president; Mr. Ralph E. Rust, of the Rust-Owen Lumber Company, secretary; Mr. George T. Thompson, of the Chippewa Valley Bank, treasurer; Mr. Walter M. Lenhart, general manager; Wm. E. Smith, auditor, and Maurice E. Bates, chief electrician.

Mr. Lenhart, upon whom devolves the management of the affairs of the company, was born in 1847 in Tazewell County, Ill. After his graduation from the high school at the age of 17, he entered a bank, where he served as clerk for seven years, after which he was connected with railway work. During the last twelve years he has been connected with several large electrical manufacturing companies, and his varied and extended experience in this line has undoubtedly fitted him for the successful management of the affairs of this company, to which he was elected on September 1, 1892.

Mr. Maurice E. Bates, the electrical engineer of the company, is a native of Massachusetts, where he first became engaged in electrical work. He was first connected with the isolated lighting department of the Edison company, and was afterwards placed in charge of the installation of Edison central stations. He was afterwards connected with the Western Electric Construction Company of Kansas City, first as superintendent, afterwards as manager, which position he resigned to accept his present position with the National Company.

Mr. C. G. Crocker, the superintendent, served his apprenticeship in his native town, Syracuse, N. Y., with the Porter Manufacturing Company, the well known engine builders. For some time he was in charge of the machine work of the Minneapolis Granite Company, and became identified with the National company soon after its organization.

Mr. Wm. E. Smith, the auditor, began his business career with the Electrical Supply Company, Chicago, where he had abundant opportunities to become acquainted with the electrical trade. For the last four years he has been with the present company.

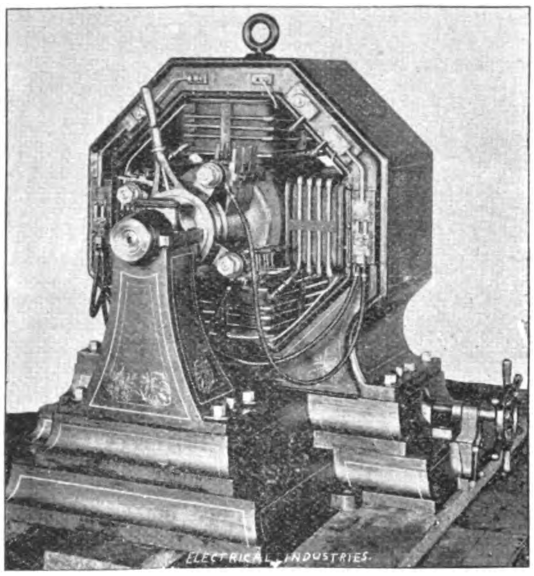


FIG. 4—NATIONAL QUADRUPOLAR AUTOMATIC GENERATOR.

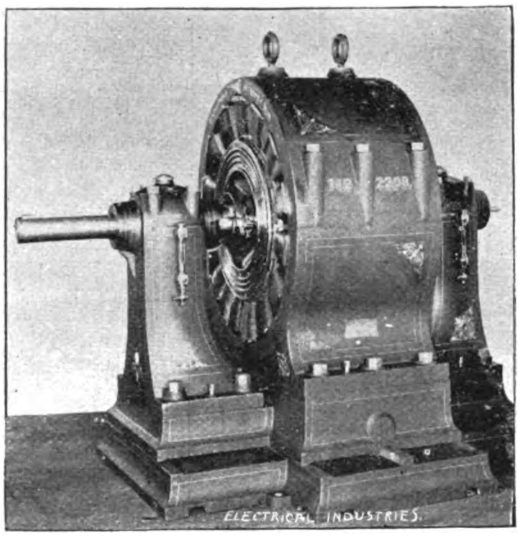


FIG. 5—NATIONAL ALTERNATOR.

The Butman Patent Vertical Boiler; Its Economy and Efficiency as Shown In Recent Evaporative Tests.

BY ISAAC V. HOLMES, M. E.

It gives me pleasure to present herewith "logs of data" of a series of evaporative tests made by me of the performance of a Butman Patent Vertical Tubular boiler located in the store building corner of Wabash Avenue and Harrison Street, Chicago, on the 28th, 30th and 31st of March, 1893. These tests were made to determine the facts relative to such a boiler's practical efficiency, both as regards capacity (pounds of feed water delivered as steam per hour), quality (or the condition of such steam, as regards the entrainment of vapor or super-heat), evaporation (pounds of steam per pound of coal), and the comparative work with different qualities of coal.

The first test was with Indiana block lump, the efficiency of which is well known to steam users.

The second test was with New River lump, a rich gaseous bituminous coal from West Virginia.

The third test made was with White-Breast Iowa coal, a very lean soft coal, about half slack and the balance of nut size, which when burned left a large amount of clinker on the grate.

The evaporative efficiency of these coals, showed as follows, from and at 212 degrees:

New River Lump, 10.82 pounds of water evaporated to one pound of coal.

Indiana Block, 9.37 pounds of water evaporated to one pound of coal.

White-Breast, 6.66 pounds of water evaporated to one pound of coal.

While from combustible, under same conditions, the evaporative efficiency was:

New River lump, 11.28 pounds of water evaporated to one pound of coal.

Indiana block, 9.86 pounds of water evaporated to one pound of coal.

White-Breast, 8.14 pounds of water evaporated to one pound of coal.

The quality of steam was determined by calorimeter tests, and thermometer as follows:

First: A thermometer cup was inserted in the top head of the boiler dome, and filled with mercury, and a thermometer placed therein.

Second: A ¾-inch pipe was inserted in the top head near the thermometer cup, projecting downward into the steam space about 6 inches, so as to take the sample midway between the vertical walls of the dome. To this was attached a ¾-inch pipe, some ten feet long, reaching to a barrel calorimeter. This pipe was thoroughly protected by a non-conducting coat, and at the barrel was provided with proper drain cocks, etc.

Third: Inserted in a 4-inch T connection, through which the steam passed from the boiler to the steam main, was a short piece of ½-inch perforated pipe, to which was connected close to the main a Heisler calorimeter, this instrument being well protected by a coat of hair felt. These instruments showed there was a constant super-heating of the steam as follows:

	BY THERMOMETER.	BY BARREL.	BY HEISLER.
First Test...........	20 degrees.	16 degrees.	4 degrees.
Second Test.........	20½ degrees.	14 degrees.	4 degrees.
Third Test..........	15 degrees.	5 degrees.	2 degrees.

The absorption of the heat from the products of the combustion, was determined by a Bulkley pyrometer, placed in the flue, where they passed from the jacket and shows as follows:

TEST NO. 1.	TEST NO. 2.	TEST NO. 3.
458 degrees.	460 degrees.	406 degrees.

Observations which were continuously made of the performance of the furnace, and which was provided with the Butman patent hot blast system also of the indications at the top of the chimney, showed a very complete combustion of both the hydro-carbon gases, as well as the fixed carbon of the coal, as there was practically no color to the smoke from the chimney during these tests.

As regards the internal circulation of the water and delivery of steam from same: The water level in the glass gauge showed no unusual pulsation or lifting of the water level, and to all appearances the boiler when worked with its maximum load of 5,500 pounds per hour, was free from all signs of unequal circulation, and I should judge from its performance that a higher load could be carried with ease.

EVAPORATIVE TEST NUMBER ONE.

Duty,......Furnishing steam for engines, elevators and heating.
Weather,.....Fair day with westerly winds.
Time,.........Continuous run of 8 hours, from 11 A.M. to 7 P.M.
Boiler,........One Butman patent vertical tubular boiler. 80 inchx17 feet 3½ inch, with 126 two and one half inch tubes, 12 feet long.
Heating surface, water exposure 1,019 sq. feet.
Furnace,.....Butnam hot blast in brick setting complete with automatic doors and shaking grates.

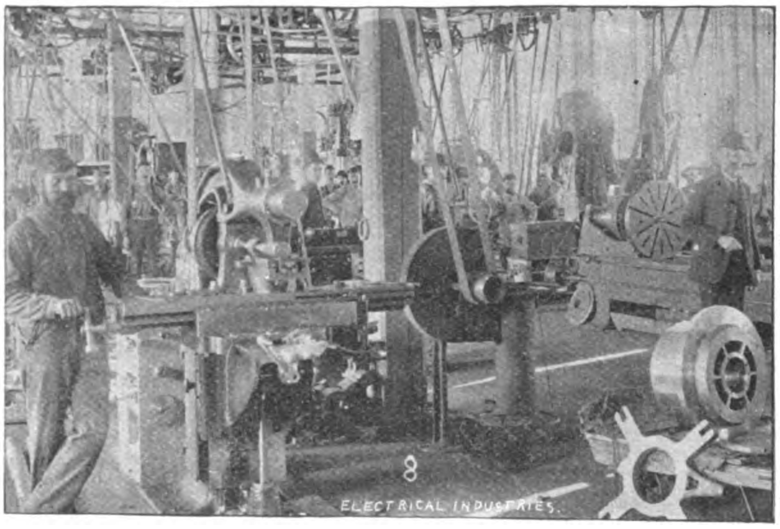


FIG. 6—NATIONAL ELECTRIC MFG. CO.—SOUTH TOOL ROOM.

Coal,..........Indian block lump, broken to proper size.

DATA.

Total Quantities—Pounds of water, delivered to boiler	40,910 pounds.
Pounds of coal, delivered to furnace,	4,600 pounds
Pounds of refuse, weighed dry	230 pounds
Pounds of combustible in the coal	4,370 pounds
Hourly Quantities—Pounds of coal	575 pounds
Pounds of combustible	546 pounds
Pounds of water maximum in one hour	5,584 pounds
Pounds of water average temperature of 194 degs.	5,114 pounds
Pounds of water evaporated per square foot heat surface	5 pounds
Pounds of coal burned per square foot grate surface	30 pounds
Averages—Pressure steam at boiler gauge	86 pounds
Temperature feed-water at meter,	194 degrees
Temperature gases at uptake,	458 degrees
Temperature steam at 86 pounds pressure	328 degrees
Temperature steam by thermometer in top of same,	346 degrees
Super-heat steam by barrel calorimeter from dome,	16 degrees
Super-heat steam by Heisler calorimeter main pipe,	4 degrees
Draft chimney at water column,	6-10 inch.
Percentage refuse in the coal	5 degrees

ANALYSIS.

Pounds of water evaporated at 86 pounds pressure and temperature of 194 degrees to one pound of coal..	8.89 pounds
Equivalent evaporation at pressure of atmosphere and temperature of 212 degrees to one pound of coal...	9.37 pounds
Equivalent evaporation at pressure of atmosphere and temperature of 212 degrees to one pound of combustible	9.86 pounds
Horse-power Developed—Commercial rating (34½ pounds from and at 212 degrees)	158 horse-power

EVAPORATIVE TEST NUMBER TWO.

Duty,.........Furnishing steam for engines, elevators and heating.
Weather,....Clear, cool day with westerly winds
Time..........Continuous run of 8½ hours, from 10.30 A.M. to 5.00 P.M.
Boiler,.......One Butman patent vertical tubular boiler, 80 inchx17 feet 3½ inches, with 126 two and one half inch tubes 12 feet long.
Heating surface water exposure 1019 square feet.
Furnace,...“Butman hot blast” in brick setting, complete with automatic doors and shaking grates. Grate surface 19 square feet.
Coal...........“New river lump,” West Virginia broken to size.

DATA.

Total Quantities—Pounds of water delivered to boiler,	33,613 pounds
Pounds of coal, delivered to furnace	3,300 pounds
Pounds of refuse weighed dry	135 pounds
Pounds of combustible in the coal	3,165 pounds
Hourly Quantities—Pounds of coal	508 pounds
Pounds of combustible,	487 pounds
Pounds of water maximum in one hour	5,494 pounds
Pounds of water average at temperature of 188 degrees	5,170 pounds
Pounds of water evaporated per square foot heat surface	5 pounds
Pounds of coal burned per square foot grate surface	27 pounds
Averages—Pressure steam at boiler gauge	84 pounds
Temperature feed water at meter,	188 degrees
Temperature gases at uptake,	460 degrees
Temperature steam at 84 pounds pressure	326.5-10 degrees
Temperature steam by thermometer on top of dome	347 degrees
Super-heat steam by barrel calorimeter from dome,	14 degrees
Super-heat steam by “Heisler” calorimeter, main pipe,	4 degrees
Draft, chimney by water column,	6-10 inch
Percentage refuse in the coal	4 per cent

ANALYSIS.

Pounds of water evaporated at 84 pounds pressure and temperature of 188 degrees to one pound of coal	10.187 pounds
Equivalent evaporation at pressure of atmosphere and temperature of 212 degrees to one pound of coal	10.82 pounds
Equivalent evaporation at pressure of atmosphere and temperature of 212 degrees to one pound of combustible	11.28 pounds
Horse-power Developed—Commercial rating (34½ pounds from and at 212 degrees)	160-horse-power

EVAPORATIVE TEST NUMBER THREE.

Duty,.........Furnishing steam for engineer, elevators and heating.
Weather,....Cool, pleasant day, with south-east winds.
Time,.........Continuous run of 5 hours from 11.30 A.M. to 4.30 P.M.
Boiler,........One Butman patent vertical tubular boiler, 80 inch x17 feet 3½ inch with 126 two and one half inch tubes 12 feet long. Heating surface, water exposure 1,019 square feet.
Furnace,....“Butman hot blast” in brick setting complete with automatic doors and shaking grates. Grate surface 19 square feet.

Coal,.........."White-breast" Iowa, what would be called nut and slack.

DATA.

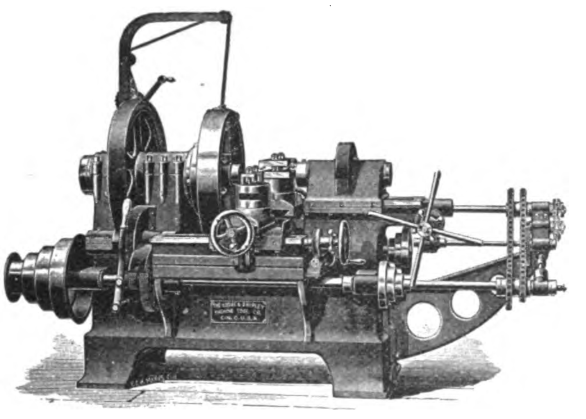
Total Quantities—Pounds of water delivered boiler	19,279 pounds
Pounds of coal delivered furnace,....................	3,043 pounds
Pounds of refuse weighed dry..........................	553 pounds
Pounds of combustible in the coal	2,490 pounds
Hourly Quantities—Pounds of coal........................	609 pounds
Pounds of coal combustible....	498 pounds
Pounds of water maximum in one hour,............	4,006 pounds
Pounds of water average at the temperature of 196 degrees..	3,856 pounds
Pounds of water evaporated per square foot heat surface	3.8-10 pounds
Pounds of coal burned per square foot grate surface..	32 pounds
Averages—Pressure steam at boiler gauge..............	82.5 10 pounds
Temperature feed water steam at boiler meter...	196 degrees
Temperature gases at boiler uptake,...................	406 degrees
Temperature steam at 82 5-10 pounds pressure,...	325 degrees
Temperature steam by thermometer in top of dome,	340 degrees.
Super-Heat steam by Barrel calorimeter from dome,	5 degrees
Super-Heat steam by Heis er calorimeter main pipe..	2 degrees
Draft chimney, water column..........................	6-10 inch
Percentage refuse in the coal..........................	17 per cent

ANALYSIS.

Pounds of water evaporated at 82 5-10 pounds pressure and temperature of 196 degrees to one pound of coal..	6.33 pounds
Equivalent evaporation at pressure of atmosphere and temperature of 212 degrees to one pound of coal..	6 66 pounds
Equivalent evaporation at pressure of atmosphere and temperature of 212 degrees to one pound of combustible...	8 14 pounds
Horse-power Developed—Commercial rating (34½ pounds from and at 212 degrees)....................	112-horse-power

The Lodge & Shipley Motor Gear Lathe.

In the accompanying illustration is shown a lathe for the production of gears for street railway motors and all heavy machinery. It is manufactured by the Lodge & Shipley Machine Tool Company, Cincinnati, O., and is capable of turning gears of 30 inches in diameter and 24 inches face.



LODGE & SHIPLEY MOTOR GEAR LATHE.

The entire bed with bearings for the head spindle and rails for carrying the turning saddles and tail-stock slides are cast in one piece. The gear on the head spindle is 30 inches in diameter. The spindle itself is 6 inches in diameter with a 3¾-inch hole clear through it, permitting of the use of a boring bar of any length. The front end of this hole is bored tapering to receive a mandrel, center or bush. The saddles are driven by means of screws, the rear one being provided with power cross feed. The front tool block is arranged to carry two tools, either of which may be revolved into position. The rear saddle is fitted with a square tool block on which two tools may be clamped for facing the sides of the rim at one operation. The power is taken from a 3½-inch double belt by a large four step cone on the main driving shaft so arranged that the speed may be regulated between two and 180 revolutions per minute.

The spindle is driven by a 11¼-inch gear from a steel pinion on the end of the shaft, which is journaled in the sleeve, the end of the sleeve being attached to the lower side of the tail-stock. The sleeve has a rack cut on its lower side which meshes with a pinion cut on the pilot shaft. On this pilot shaft is a worm wheel and clutch for engaging the power feed. The worm shaft is driven from the tail-stock shaft by means of gears. Two feeds are provided, the change from the one to the other being made by sliding a key. The boring bar takes its bearing in the live spindle and secures an absolutely accurate hole. The chuck is fitted with clamps and adjusting screws. The drives and feeds of the boring bar are all positive. By means of a forked rest in the centre of the bed adjusted by means of screws the work is quickly centered. Attached to the back of the head stock is a swinging crane for handling the work about the lathe.

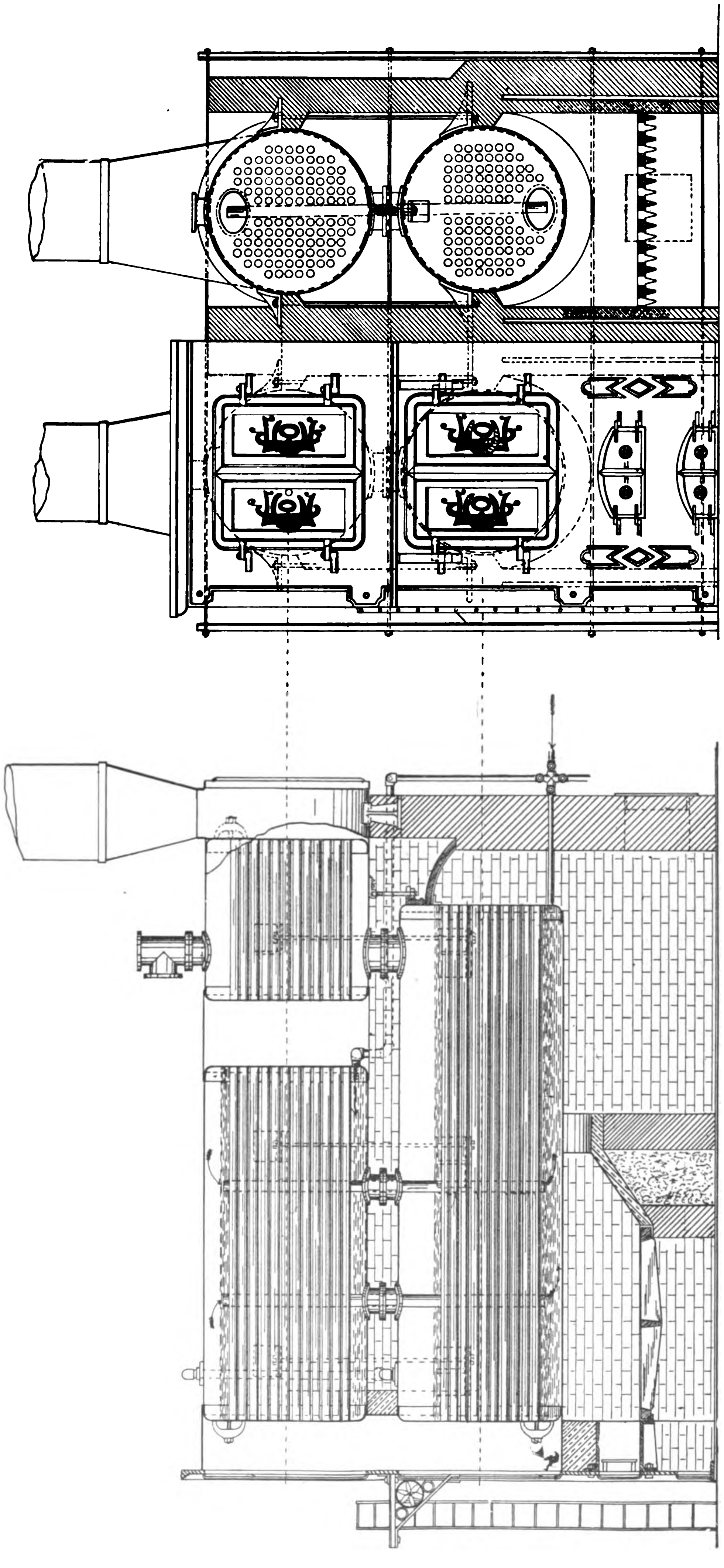
The Scotch Compound Tubular Boiler.

The State Street Railroad Company, New Haven, Conn., is installing a boiler plant of the type shown in the accompanying illustration in connection with its new electrical equipment. This well known type of boiler belongs to the progressive heating class. Although differing somewhat from the methods usually employed in this country, many of our readers will recognize the correct principles of steam generation, wherein the falling temperatures of the gases of combustion are adjusted to the rising temperature of the water and steam.

The illustration exhibits nearly all the various parts, and the course of the water indicated by arrows. In this case there are to be when the plant is fully completed eight sets of these boilers, two of which will be in operation on or before July 1st. One complete boiler comprises: One 60 inches by 16 feet shell with 96 three-inch tubes 16 feet long. Over this shell there is to be another water compartment 60 inches by 11 feet, having 114 three-inch tubes 11 feet long. Also the steam super-heater, which will be 60 inches by five feet long, containing 112 three-inch tubes five feet long. This shell will be extended 18 inches to accommodate the stack. The grate being situated under the 60 inch by 16 foot shell allows the heat to traverse the under side of shell, thence through the 16 foot tubes, ascending to the overhead compartment, it passes through tubes of upper water compartment; thence through the five-foot tubes in super-heater, passing out at the stack to atmosphere. The water enters at the bottom of the rear end in top water compartment, gradually ascends to the top and overflows into the upright pipe, which conveys the water to the bottom shell. Steam is given off from the surface of the water in this shell and ascends into super-heater, through which it reaches the steam pipe.

The special claims for this boiler is, great economy in fuel, dry steam and exemption from explosions. The impurities contained in the water are deposited in the top compartment, where the intense heat does not reach, therefore they can be easily removed by means of a blow-off pipe. Existing plants of tubular boilers can be remodeled very cheaply.

The California Engineering Company of Chicago, Ill., has secured the patent rights of this boiler for the United States. The balance of the power equipment for the New Haven line will consist of two pair of compound improved Wheelock engines with Hill valve system, each having a capacity of 500-horse power to be equipped with the Head-



THE SCOTCH COMPOUND TUBULAR BOILER—BEING ERECTED FOR STATE STREET RAILWAY COMPANY, NEW HAVEN, CONN.

ley compound rope transmissions, erected under the Dodge Hizeroth, McDonald, Williams & Hoadley patents. Surface condensers with independent pumps are to be used. Westinghouse generators are to be used, divided into 250-horse power units. The entire plant is being erected by the California Engineering Company of Chicago, Ill. Hoadley Brothers, engineers.

Decision of the Columbia Incandescent Lamp Case.

In the case of the Edison Electric Light Company et al *vs.* Columbia Incandescent Lamp Company et al in the United States Circuit Court of the Eastern district of Missouri, the decision of Judge Hallett April 21st on the motion for preliminary injunction was looked forward to with the greatest interest by the entire electrical fraternity. The case is of the utmost importance and has given the monopoly of the incandescent lamp business a blow from which it seems it will not be able to recover. The arguments of the learned counsel on both sides was very able and efficient. Great interest was manifested by those present. After taking the matter in hand for just one week Judge Hallett gave his decision. The injunction was refused and we give herewith the text of the opinion.

Complainants allege infringement of letters patent No. 223,898, issued to Thomas A. Edison, January 27th, 1880, for an improved electric lamp. This patent came under the consideration of the Circuit Court of the Southern District of New York, in the case of Edison Electric Light Company vs. U S. Electric Lighting Co. (47 F. R. 454), and was held to be for a lamp "consisting essentially of a filamentary carbon burner, hermetically sealed in a glass vacuum chamber." So understood it is the incandescent lamp in common use, and no question is presented in this record as to the character of respondents' manufacture. The defense to the bill and to the motion for preliminary injunction now under consideration is want of novelty in the Edison patent. Respondents aver that an incandescent lamp different in form, but in all essential features the same as that now in general use, was made as early as 1854 by Henry Goebel, of New York City, and that it was used by him in various ways and at different times for many years thereafter. It will not be necessary to describe this lamp at length, as it has the same constituents as the Edison lamp. We are at present more concerned with the struggle between the contending forces, on the one side to maintain and on the other to disprove, the existence and use of the lamp anterior to the date of the Edison invention. A large mass of testimony, in the form of affidavits, is offered by each party on the question of fact, which, to consider at length, would be a tiresome and unprofitable task.

The principal objection urged by complainants against the Goebel invention is that it has an impossible date; no man *could* make it in the time and manner assigned to it; the incandescent lamp is the product of several auxiliary arts not likely to fall within the campass of a single mind; as an achievement of science the lamp is a matter of progressive steps, some of which must be made by the world at large, before others can be taken by any one. This is no more than to say that no man can outrun his competitors to any great length in the field of scientific investigation—a proposition which has no support in reason or experience. There seems to be no reason for saying that Goebel could not reach, in 1854, the point attained by Edison in 1879, unless as was said by the dissenting justices in the telephone cases: "it is regarded as incredible that so great a discovery should have been made by the plain mechanic, and not by an eminent scientist and inventor."

In so far, however, as it may be shown that the methods adopted by Goebel were not equal to the results obtained, the evidence should receive the most careful consideration. On this point it appears that Goebel has recently made several lamps of the form and with the material and tools formerly used by him. These lamps were tested by men of skill and experience in such matters and they were found to be reasonably effective. They are not so good as the lamps in common use, but they can be operated and they give reasonable service in time and capacity of light. So that in this way we have *prima facie* proof of Goebel's ability to make lamps in the way he claims to have made them before the time of Edison's invention.

It is said that Goebel is involved in contradictions and misstatements of facts, due to the lapsing memory of old age or to untruthfulness. Be it so; he does not appear to be an adventurer or an impostor. It is not reasonable to believe that he made the story related in his affidavit and did not make the lamp he has described. Whatever may be said as to Goebel's veracity, he is supported at many points by witnesses of good repute, who speak with precision and, apparently, with deliberation.

As already suggested, it is not necessary or profitable to go over the testimony at length, with a view to determine the relative value and weight of every part. It is enough to say that there is a fair preponderance of testimony in support of the Goebel claim.

There is not the measure of proof demanded by complainant's counsel who maintain that the Court should require proof of the fact beyond reasonable doubt. This degree of certainty is not often attained upon testimony in the form of affidavits where the issue is contested. And it is not reasonable to demand such certainty as to the defense. Complainants must show a clear right in support of a preliminary writ and a defense which puts the case in doubt is sufficient to defeat the application.

> Goodyear Co. vs. Dunbar, 1 Fisher, 472.
> Glaenzer et al. vs. Wiederer et al. 33 Fed. Rep. 583.
> Fraim vs. Sharon Valley Malleable & Gray Iron Co., 27 Fed. Rep. 457.
> Cary vs. Domestic Spring-Bed Co., 26 Fed. Rep. 38.
> Robinson on Patents, 1171.

It is also contended that the decree of the Circuit Court of New York against the United States Electric Lighting Company sustaining the patent, which decree has been affirmed in the Court of Appeals of the Second Circuit, is conclusive of complainants' right to the writ for which they now ask. No doubt is entertained as to the conclusive effect of that decree here and elsewhere as to all matters in issue in that cause. For although respondent was not a party to that litigation, the Court would not on a preliminary motion consider any matter which passed to judgment in that suit. But the Goebel defense was not made in that suit and therefore the case has not the authority on this motion which has been ascribed to it.

> National Hat-Pouncing Machine Co. vs. Hedden et al. 29 Fed. Rep. 147.
> Lockwood vs. Faber, 27 Fed. Rep. 63.
> The Bailey Wringing Machine Co. vs. F. F. Adams et al., 3rd B. & A. 96.

Another suit by the complainants against Beacon Vacuum Pump & Electrical Company in the Circuit Court for the District of Massachusetts, is in a different attitude. In that suit the Goebel defense was made and upon motion for preliminary injunction recently heard and allowed, it was overruled. It is contended that the ruling in that case should be recognized and followed as a precedent in respect to the present motion. And perhaps, if the issue, the testimony and the situation of the parties appeared to be the same in both cases, such result might follow; more from the persuasive effect of the opinion of another court on the same matter than from any notion of authority ascribed to such opinion. In courts of equal jurisdiction proceeding concurrently in the investigation of the same subject the right and duty of each to exercise independent judgment can not be denied. That they should in the end reach the same result is greatly to be desired, but one can not become an echo to the other for that praiseworthy purpose. In this instance the consequences to flow from diverse opinions are not regarded as serious. In the Massachusetts Circuit, and here as well, the motion is interlocutory; and in each case the ruling may well enough stand upon the situation of the parties. And we have much additional testimony to that upon which the Court acted in the Beacon case; so that upon all points I do not feel compelled to accept the opinion of the Court in that case.

The ruling of the Court, however, in the Beacon case suggests the propriety of taking security from respondents for observing the decree in case complainants shall ultimately prevail in this suit. There are other considerations also which should have weight in that direction. It was suggested by complainants' counsel that respondent is a concern of small capital; and that it was made so with intent to avoid responsibility in respect to the infringement now alleged against it. This was not denied and I suppose we may take it to be true. The retort was in the form of a charge against complainant that it used its monopoly of electric lamps to control the sale of all kinds of electric machinery and apparatus. This charge also passed without denial; and it is not difficult to conceive of circumstances in which it would be necessary to ascertain whether it is true. Referring only to the charge against respondent of insufficient capital and assets, the duty of the Court is plain to provide for the contingency of a decision against it. I need not refer to the possible effect of cross-examination in the case of a multitude of witnesses. What now seems plain enough may altogether disappear and new facts may come to the surface under that crucial test.

The injunction will therefore be refused if the respondents shall give a bond in the sum of $20,000.00 conditioned for the payment of such sum (if any) as may be decreed in favor of complainants on the final hearing of this cause. The bond to be filed with the clerk of the court and to be approved by the clerk or by a judge of the court within twenty days from this day.

The Cleveland Electrical Manufacturing Company, Cleveland, O., will display a number of its American watchmen's time detectors together with electric time and fire alarm devices. It will also display in its booth the system as it is in actual operation in the buildings of the Exposition, a complete system, from 150 to 200 stations connected by this system having been installed in a number of the Exposition buildings.

The Bangkok Tramway.

The following description, from the Bangkok (Siam) "Times," of the Bangkok electric street railway, recently completed, may be of interest: "The installation covers a distance of a little more than three miles. The plant consists of two 80-horse power single cylinder automatic cut off engines built by the McIntosh & Seymour Engine Company, having a twelve and one-half inch cylinder and a twelve inch stroke, working at 284 revolutions per minute. The engines are driven by steam from two horizonal tubular boilers. The furnaces are large and especially adapted for wood fuel. There are two generators, giving 100 amperes at 500 volts, each capable of being worked single or in parallel. The over head wire consists of number two hard drawn copper, and is suspended by steel brackets and insulated hangers from poles at the side of the road. The entire length of 17,200 feet is in three pieces only, joined by two sleeves. The return current is conveyed through the rails which have been carefully connected by galvanized iron wire bonds, passed through holes drilled in the extremity. These bonds have in turn been soldered to the supplementary wire running the entire length of the track, and which is connected to the switch board at the central station.

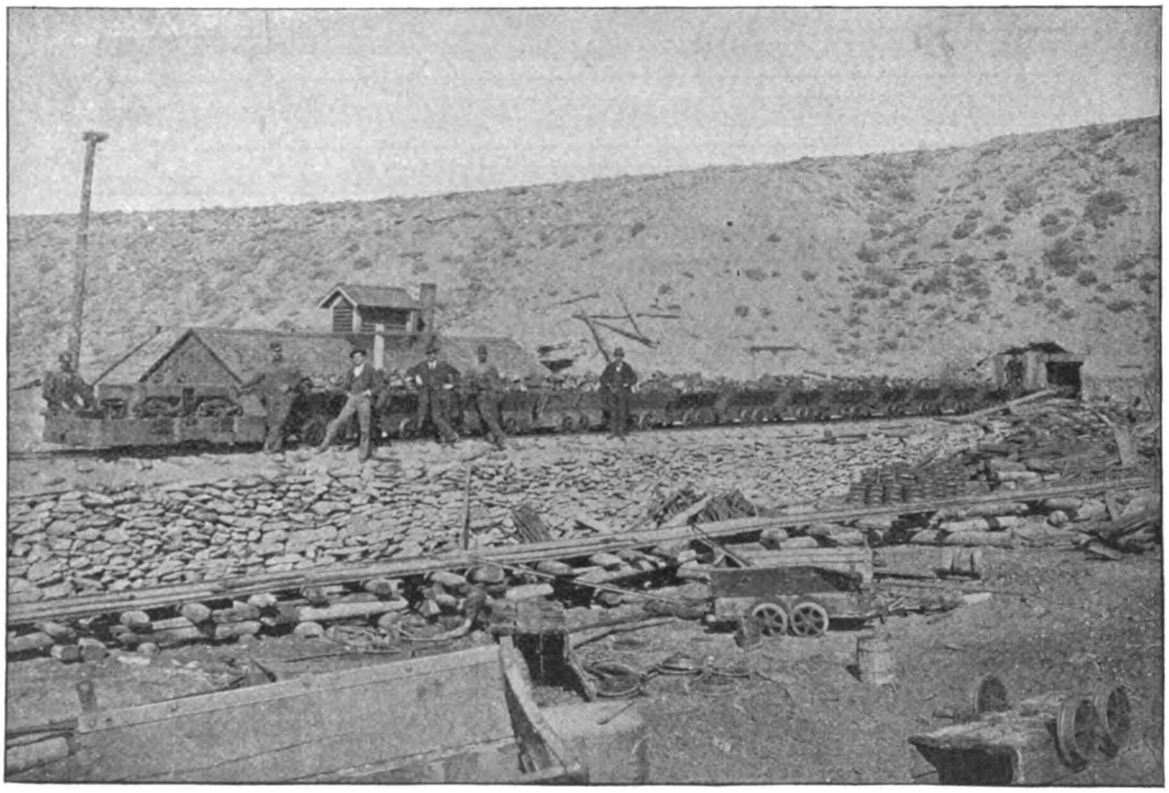
The cars, very solidly built of teak, are mounted on an all iron truck especially adapted for tramway service, and carrying a 20-horse power motor. They are also fitted with five 16-candle power incandescent lamps. The speed attainable by the new cars is about 20 miles an hour, but about 15 miles per hour will be the maximum speed on clear runs. The artistic design, combined with the solidity of the engines, generators and general plant, together with the finish given to every detail of the machinery supplied, point to the fact that the Short Electric Railway Company has spared neither time, trouble, nor expense in keeping their name in the east on a par with the very high reputation they have acquired in the electrical engineering world. The reputation has not suffered any loss at the hands of their efficient and genial representative, Mr. W. J. Davidson, who has so successfully carried out their contract in Siam."

The contract and arrangements for the installation of this plant were made through Mr. E. J. Bagnall, of the firm of Bagnall & Hilles, agents for the Brush Electric Company in China and Japan.

Electric Traction In A Coal Mine.

At the Rock Springs Coal Mine at Rock Springs, Wyoming, there has recently been installed by the mining department of the Northwest General Electric Company an electric locomotive with the necessary plant and apparatus. The power station is about a mile from the mouth of the mine, in which is an 80-horse power generator driven by a steam engine.

The current generated is of 550 volts, the drop being estimated at 10 per cent between the power house and the mine. The feed wire and wire for the return current is of No. 000 bare copper. A circuit breaker is placed near the mouth of the mine so that the current may be shut off from the mine when the locomotive is engaged in switching. The overhead trolley system is used. The electric locomotive was manufactured by the General Electric Company, and is of 60-horse power. As used in the mine its speed is about eight miles an hour. The cars, when loaded, weigh about 3,000 pounds and 30 cars are run from the loading point to the end of the track, a distance of about one and one-sixth miles in 20 minutes. The track is of 35-pound T rails and 30-inch gauge. There are a number of switches and spurs used in the hauling of the coal.



ELECTRIC LOCOMOTIVE AND TRAIN—ROCK SPRINGS (WYO.) COAL MINE.

In the accompanying illustration is shown the electric locomotive and a train of coal cars. The successful use of this plant will undoubtedly help to extend the use of electricity in mines and in mining regions, for which it is so well adapted.

The Cummings Underground Conduit System.

The Underground Conduit System introduced but recently by Cummings & McCoy of Detroit, Mich., has been tested by the superintendents and managers of several large electric light and power plants, who report that the conduit fulfills all that was promised for it. This system is constructed and adapted for bare wires carrying high potential currents. The conduit so perfectly insulates the wire, that other wires in the vicinity are not affected by them. As will be seen from its construction, it is not liable to injury from picks or tools in the hands of workmen employed in laying pipes, etc., near it.

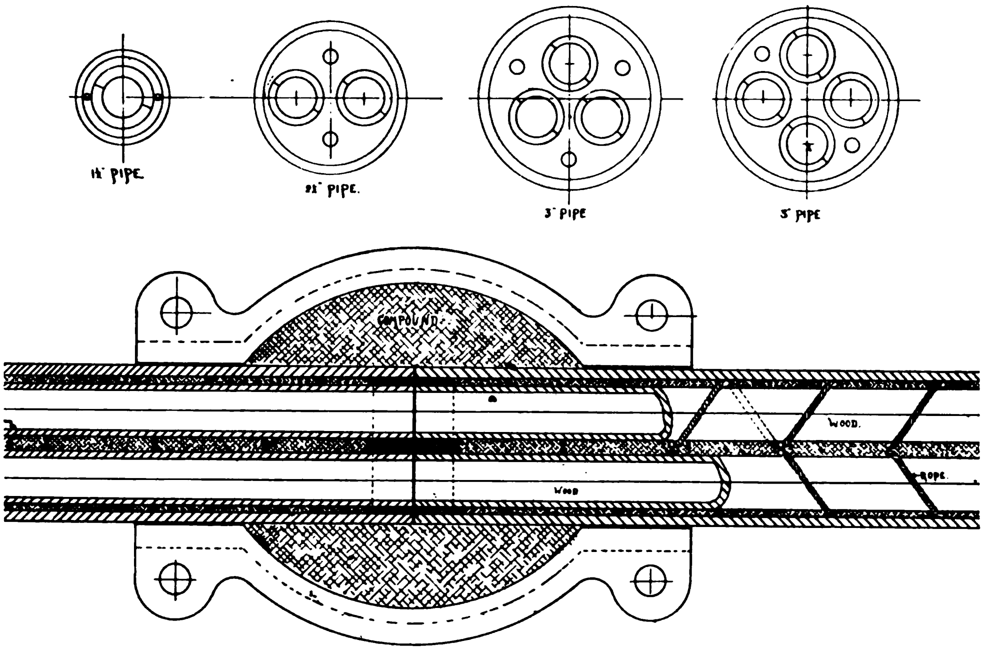


FIG. 1.—CUMMINGS UNDERGROUND CONDUIT SYSTEM.

The general plan of the construction of the conduit is as follows: the inner part of the conduit consists of a wooden tube made in halves, which are manufactured by a machine devised for that purpose. When the halves are placed together, first having been soaked in paraffine or oil to render them a more perfect non-conductor, a rope is wound around them in a spiral, holding the parts together and separating the tube from the outer wrought iron pipe, into which this inner tube is placed. The spiral opening between the separate coils of the rope and between the two casings of the conduit, is filled by some hot liquid insulating material, as asphaltum, which on cooling, hardens and cements the different parts of the conduit together. The different sections are fastened together by a cast iron coupling made in halves, as shown in the illustrations clamped to the sections of conduit by bolts. A flexible rubber sleeve is slipped over the joint before this coupling is put on. After the coupling is in place and bolted, the hollow space within the coupling and around the rubber sleeve is filled with asphaltum through a hole left for that purpose. The couplings are also made for branches, at places where service is desired.

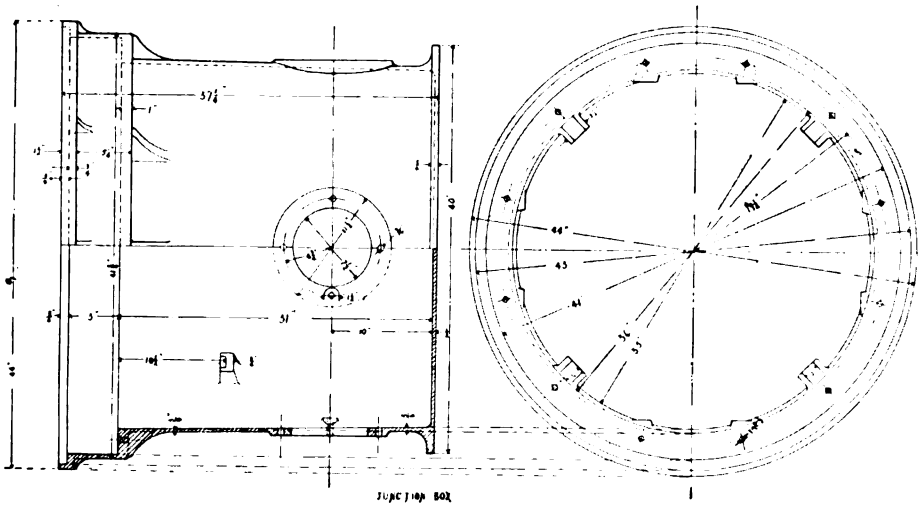


FIG. 2.—CUMMINGS UNDERGROUND CONDUIT SYSTEM.

Junction boxes are manufactured of a size and design adapted for the different systems for which the underground conduit is used. Fig. 2 shows design of junction box with connections for the round conduit. These boxes are made so that when connected, with cover fastened, are absolutely water tight. They are fitted with switch board and arrangements for all connections. Cables used in this make of conduit do not need to be lead covered. A covering strong enough to hold the cable together when pulling in, is all that is necessary. When lead covered cable is used, the manufacturers guarantee that there will be no deterioration in the lead covering. In Fig. 3 is shown a cross section of conduit designed for telephone and telegraph wires or cables of any description. It is a cast iron box made in six foot sections. The inner tubes are wound and prepared similar to the former arrangements and separated by hard rubber insulating blocks with an insulating compound poured around the tubes. Junction boxes are made on about the same plan as for the round conduit. This style of conduit is not designed for bare conductors.

The style of conduit introduced by this firm for bare conductors of high potential currents, is worthy of the attention of electrical men. It is simple in its construction and it is durable. For insulation and cost of construction it is said to be in the front rank. Mr. W. H. Fitzgerald, manager of the Detroit Electric Light and Power Co., in order to test the conduit, had one of their high potential circuits, a bare wire carrying 3000 volts, laid in Cummings underground conduit and this spring he reports that the insulation is as perfect as when the wire was put in and that he has had no trouble with either conduit or wire.

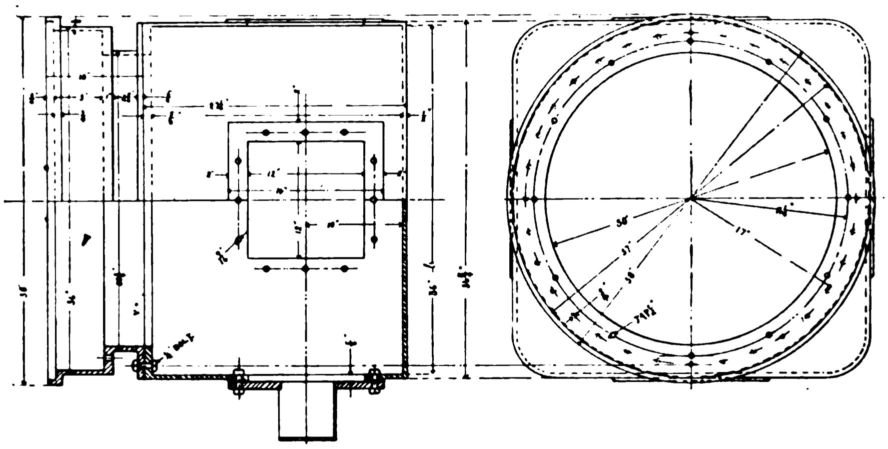


FIG. 4.—CUMMINGS UNDERGROUND CONDUIT SYSTEM.

The Underground Trolley.

The antagonism to the overhead trolley system and the defects attributed to it of unsightliness and danger has caused many persons to turn their attention to devising methods for the construction of underground trolleys. Various schemes have been offered for underground trolleys with and without a covered conduit. One of the greatest difficulties is to secure a good insulation for the trolley. When open conduit is used where the streets are not properly drained the conduit becomes a sewer for all the surface water, resulting in a great loss of energy. In the methods of closed conduits yet devised the extra cost and the multiplicity of parts will prevent their use.

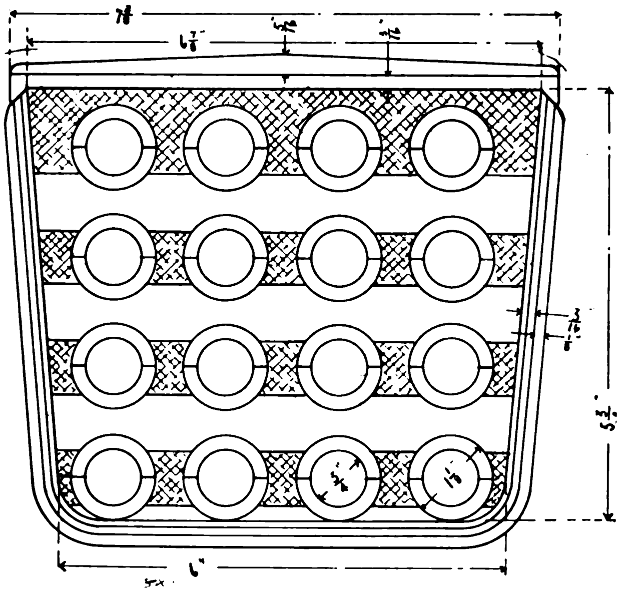


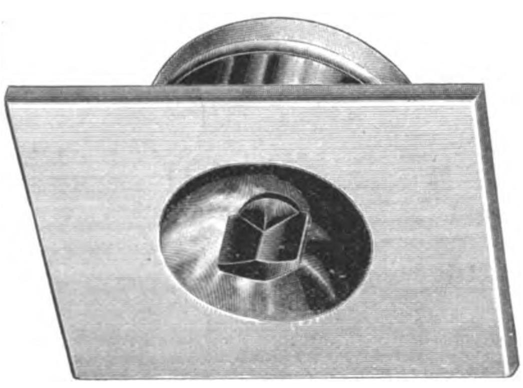
FIG. 3.—CUMMINGS CONDUIT SYSTEM.

In the system of underground trolley invented by Melone Wheless of Tennessee, and recently tested at Washington, D. C. The trolley is divided into sections 200 feet long which are fed from a separate feed wire. As the car passes from one section to another the preceding section is disconnected and the section beneath the car is connected to the feed wire. The feed wire is covered with an insulated covering and only the 200 feet of bare trolley composing that over which the car is passing, is in circuit at any one time. The connections are made with the feed wire by means of electro magnets placed in the iron switch boxes at the beginning of each section. As the car enters a section a storage battery on the car excites the magnet and lifts an iron armature which connects the trolley and feed cables, at the same time the main line current cuts out the local battery. By turning a reversing switch the car may be made to travel in either direction.

The Hart Flush Switch.

A flush switch that has several points of merit, has recently been placed on the market by the Hart & Hageman Manufacturing Company of Hartford, Conn.

The switch proper is surrounded by a metal shell fastened to the cast-brass plate, to which the switch is so attached that it can easily be taken apart for wiring. The brass plate is held in place by screws, the switch and case fitting into a recess made in the wall. Over the plate is placed a finished cover of heavy sheet-metal with flanged edges and fastened by the switch handle. No screw heads show on the surface of the switch, thus avoiding the use of specially finished screws to match the finish of the switch. Common flat-headed screws are all that are needed to hold the switch in place. The switch is finished in any of the standard finishes and, when desired, in special designs and finishes. It presents a neat appearance when in position.

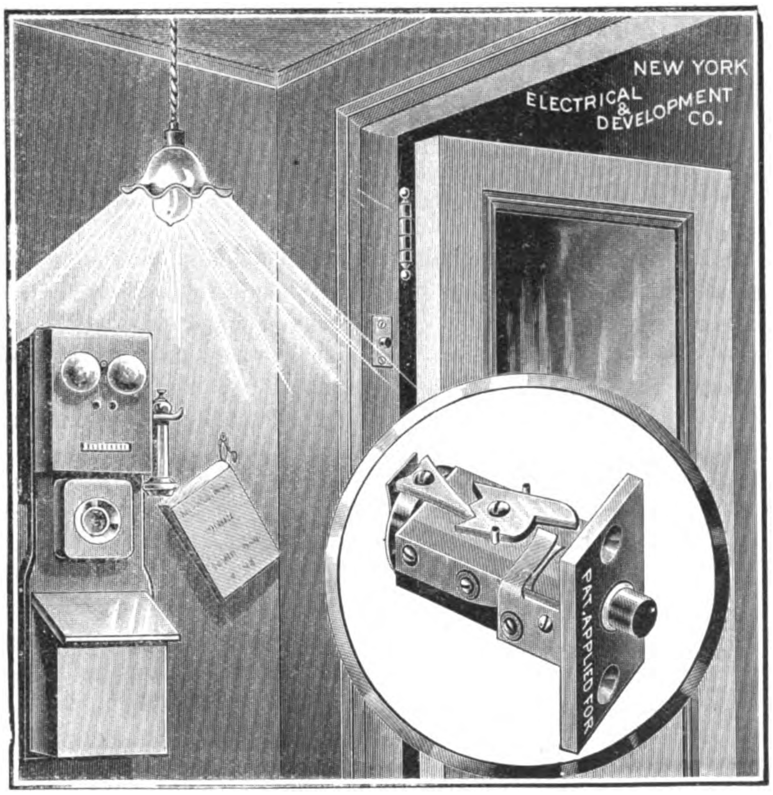


THE HART FLUSH SWITCH.

An Automatic Electric Light Switch.

A novel and ingenius electric light switch has recently been placed on the market by the New York Electrical & Development Company. By its use the lights are turned on on entering, and turned off upon leaving a room. It is especially useful and valuable for telephone booths, storage rooms, refrigerators, bank vaults and places where only an occasional light is necessary and economy in its use is desired.

The switch is operated by the opening and closing of the door. It is attached to a plate which is sunk in the door jam, the opening of the door allowing a push button to spring out which is again pushed in when the door is closed. This push button operates a shaft running through a block of fibre with a circular stop at its rear end. On this stop is fixed a small bar which presses against the end of a metallic knife edge swinging on a pivot. This knife edge is forced against contact pieces, when the door is open, making the circuit complete. On closing the door the knife edge, by the pressing in of the push button, is released from the contact pieces, thus opening the circuit and putting out the light.



AUTOMATIC ELECTRIC LIGHT SWITCH.

Electric Light Buoys for the World's Fair.

A large amount of money has been spent in building docks, wharfs and viaducts, in dredging, etc., to increase to the fullest extent the facilities for the transportation of the crowds by way of Lake Michigan to the World's Fair grounds. The large number of boats employed in this service necessitated extra precautions to guard against accidents. At first it was planned to anchor a line of spar buoys making a short and safe way from the wharf at the foot of Van Buren street to the pier at the Exposition grounds, the boats going on one side of this line and returning on the other. But when it was decided to keep the Fair open at night, the problem of properly marking a safe course to it became a problem of considerable magnitude.

Through Commander J. J. Brice U. S. N., in charge of the Ninth Lighthouse District, the United States Lighthouse Board were communicated with and permission asked to place a line of electric lighting buoys. The matter was referred to Capt. W. S. Schley U. S. N. inspector for the Third District United States Lighthouse Establishment. In the meantime Congress appropriated $20,000 for this purpose.

Capt. Schley, in company with Mr. Ira W. Henry, electrical engineer for the Bishop Gutta Percha Co., of New York, who installed the Sandy Hook plant visited Chicago for the purpose of examining the course and determining the system best suited to accomplish the desired end. It was found that the system adopted at Sandy Hook could not be used both on account of the expense and the position of the line, and a new system was worked out by Mr. Henry.

A conference was held during which Mr. Reed, manager, and Mr. Marks, superintendent of the Bishop Gutta Percha Co., agreed to undertake the construction of a cable which would withstand the high pressure and mechanical strain, involved in the new system, and would guarantee its successful operation.

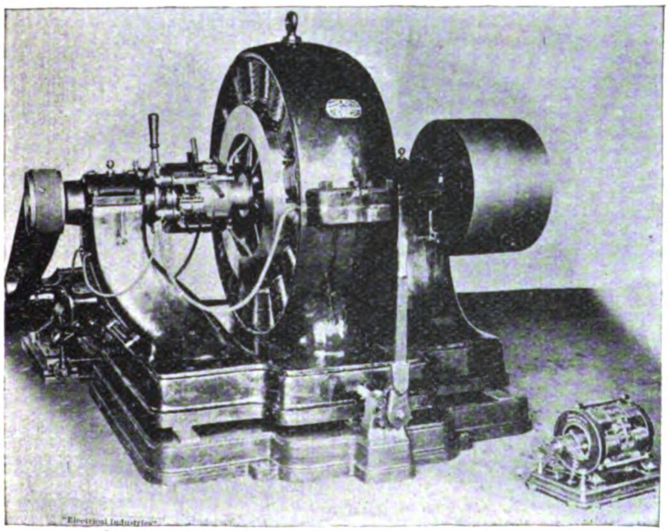
There will be thirteen buoys anchored about one-half mile apart, the first being about three-quarters of a mile from shore and the others being out from one to two miles, in order to avoid the Hyde Park shoal. The lights will be in series, incandescent and 100-candle power each. The current will be supplied by the exposition company and will be an alternating current delivered at 2,000 volts at a building at the end of the wharf at the Fair grounds where it will be transformed to a current of 1,460 volts by a transformer now being manufactured by the Westinghouse Electric & Manufacturing Company. In this building will be placed all the necessary instruments controlling the current. This submarine cable is of number eight stranded copper wire, insulated with gutta percha and protected by iron. Its total length will be about fourteen miles and it is probably the longest submarine cable ever manufactured carrying a current of such a high potential.

This submarine cable is being manufactured by the Bishop Gutta Percha Company, of New York, who will have the system in operation by June 1st.

New Wood Arc Dynamo.

In the accompanying illustration is shown a new Wood dynamo manufactured by the Ft. Wayne Electric Company and recently installed in its exhibit in the Electricity building at the World's Fair. It has a capacity of 1,500 lights, being self regulating and very simple in its construction. A great deal of pains has been taken in the finishing of this machine to make it as attractive as possible.

The entire lower part of the frame is cast in one piece. The new feature of the machine is the construction of the core. This is not made up of continuous wire windings but of U shaped punchings of soft iron one-sixteenth of an inch in thickness and so placed that each of them is separated by a space one-sixteenth of an inch from the next. Thus each stands disconnected and when the dynamo is in motion the current of air passing through the air spaces keeps the core cool. In testing this machine the number of lights was changed at the switch board from 500 to 1,000 to 1,500 and then to intermediate points but no sparking was observed and the machine responded quickly to the increase of current. In the illustration is also shown a view of the first machine made by Mr. Wood, its inventor. A number of sizes of this machine are manufactured namely, 750, 1,500, 3,000 and 6,000 lights capacity. Formerly the company turned out arc dynamos of six sizes and four styles of lamps. At present it manufactures nine sizes of arc machines, 26 styles of arc lamps and 13 sizes of incandescent dynamos, from 25 to 1,600 lights. It also manufactures 12 sizes of power generators from one-horse power to 150-horse power and 13 sizes of motors from one-fourth horse power to 160-horse power.



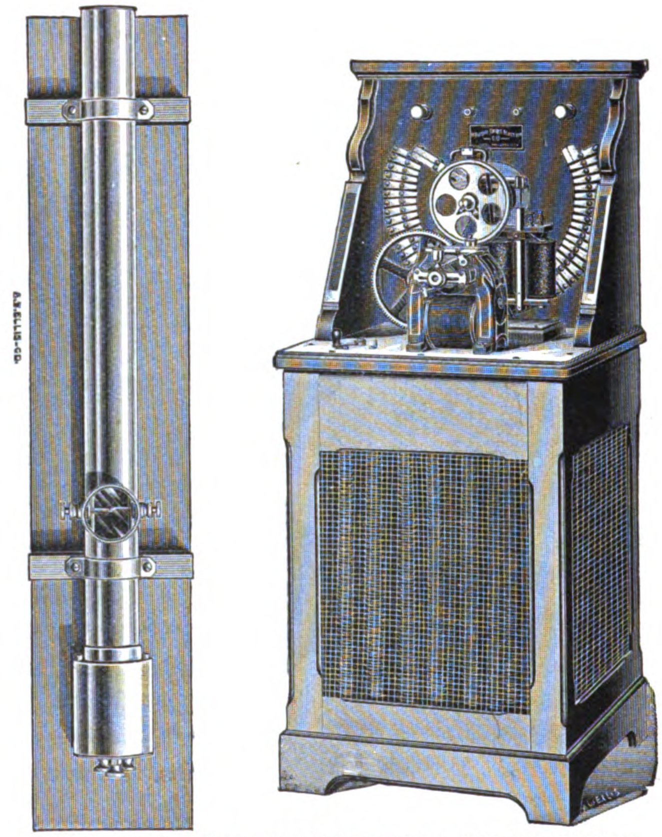
NEW WOOD ARC DYNAMO.

It is reported that the syndicate which recently purchased and consolidated the street railways of Cleveland, Ohio, will reduce the fare to four cents.

New Current Indicator and Controller.

A new current indicator and controller adapted for either the direct or alternating currents has recently been placed on the market by the Holtzer-Cabot Electric Company, 92 Franklin St., Boston, Mass.

The indicator, shown in Fig. 1, is built on the principle of the Carden voltmeter. It is very sensitive, is not affected by shocks or vibrations in the building and has no temperature error. Signal lamps of various colors may be operated by the device, so arranged that for too high a voltage a colored lamp may be made to burn, and for too low a voltage a lamp of another color. In Fig. 2 is shown the controller which is directed by the indicator. Power is furnished it either from a small motor as shown in the cut or by shafting to which it may be connected. It can be attached to any rheostat and if desired it is furnished with rheostat and motor connected as shown in the illustration.



FIGS. 1 AND 2.—NEW CURRENT INDICATOR AND CONTROLLER.

It can be used to advantage on any lamp or power circuit, and gives a more uniform current than an attendant could give. In the different plants where it has been introduced, among which is the plant of the Anheuser Busch Brewing company at St. Louis, Mo., the controller is being used successfully and economically.

A Novel Test With Two Dynamos.

The Watertown Street Railway Company of Watertown, N. Y., has two dynamos that furnish power for its line. One of these dynamos is located on Beebee island and has a capacity of 100-horse power. The other, is located on the north side of the river, with a capacity of 250-horse power. The voltage of one machine is 500 volts and the other 400 volts. At various times it has happened that the company was seriously inconvenienced in not being able to move several cars with only a very short distance between them. Mr. Edward A. Barber, the electrician of the company, however, conceived the idea of connecting the two generators together by a heavy wire which he did and on April 23rd tested the matter by placing ten motor cars 25 feet apart and running them from one end of the line to the other. The feat was easily accomplished, the belts only slipping for an instant, then immediately balancing and running together perfectly. The test made was much of a surprise to the party of prominent men of the city, who saw it, including officers of the electric light company as well as those of the railway company.

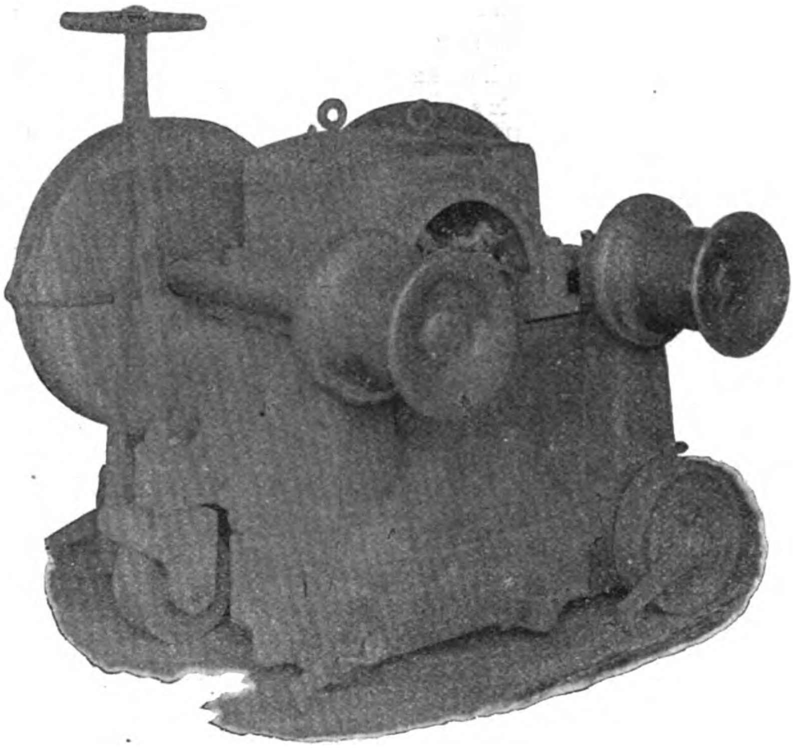
General Electric Company's Four Winch Hoist.

The four winch hoist for use on wharfs and vessels, is the latest device of this character perfected by the General Electric Company. It has been designed to meet a growing demand for a hoist that will fulfill the varied requirements of ship and dock work.

The many advantages that it possesses to which the steam hoist cannot lay claim, are apparant; it is compact, less weighty and does not require a trained engineer, it can be used in cold weather without the loss of power by great condensation of steam and it has no burst or leaky pipes connected to it, as with hydraulic hoisting apparatus. The winch head hoist is more convenient for ship use than the dum hoist as it is better adapted to the variety of hauling and hoisting incident to the manipulation of a ship's cargo. A number of loads may be raised or lowered simultaneously, each winch head being independent of the others. The apparatus illustrated consists of a base frame, a motor, two shafts, each carrying two winch heads and the necessary controlling apparatus. The frame is a strong cast iron box open at top and bottom, and supporting on its upper rim the motor and winch shaft-bearings, each furnished with a self oiling mechanism The frame is provided with wheels for convenience in moving. The motor is entirely enclosed by its own frame except two small openings allowing access to the brushes and armature bearings. The field coil of the motor and the winding of the iron clad armature are covered with a special waterproof composition.

The winch shafts are of sufficient diameter to obviate the possibility of bending under heavy loads. The winch heads are keyed to the shafts over bronze bushings, thus preventing any injury from rust. Each winch is provided with two safety pawls, which, when the hoist is in operation, are held out of action by centrifugal force, but immediately catch into notches provided in the bearing cup, if the current should fail for any cause while a load is being hoisted, the apparatus for controlling the hoist is placed below the motor within the frame where it is protected from mechanical injury and moisture.

The hoist shown in the accompanying illustration is built for 110, 220 and 500-volt circuits, as desired and require 360 amperes on 110-volt circuits, the hoist weighs 8,000 pounds and has a lifting capacity of 3,000 pounds—two weights being lifted simultaneously. The normal speed of the motor is 450 revolutions, while its speed of lifting is 250 feet per minute.



GENERAL ELECTRIC COMPANY'S FOUR WINCH HOIST.

Chicago Twin Wire and Long Distance Telephone Co.

The ordinance authorizing the above company to construct and maintain for a period of 25 years in the streets and alleys of the city a line of wires and conduits for telephone purposes was passed by the City Council of Chicago on April 17th over the Mayor's veto. In the district bounded by Belmont and California aves., Seventy-Ninth street, and the Lake, the wires are to be placed underground. No poles are to be placed in the streets when alleys can be used.

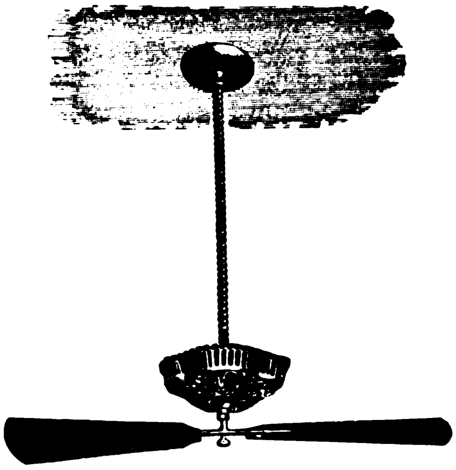
5,000 telephones are to be in use by December, 1895. The rates are not to exceed $75 for each instrument for the first year, $70 for the second year, and $65 for the third year. To the city offices there are to be no charges. The city has the right to use the top of all poles erected for city telephones and telegraph wires free of charge, and five per cent of the gross receipts of the company is to be paid semi-annually into the city treasury.

C. E. Lee, who has been well known to the trade as the Chicago representative of the Electric Gas Lighting Company, has removed to 65 Lees' Building, where he will carry a stock of Samson batteries and other specialties.

The Star Electric Fan.

A fan, which has several commendable features, is shown in the accompanying illustration. It is manufactured by D. L. Bates & Bro., Dayton, O. The first feature, that attracts the attention of the purchaser, is the ease with which it can be put up or taken down.

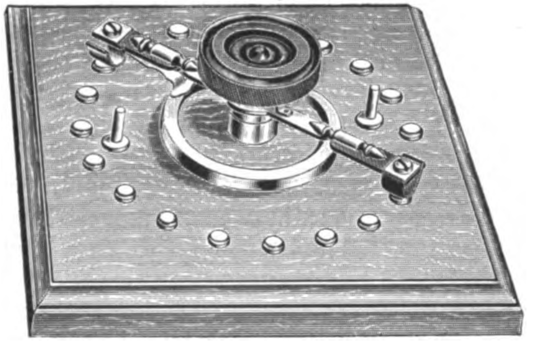
It requires but a simple hook, screwed into the ceiling, that hooks into the eye in the end of the rod under the canopy, by which the hook and end of the rod is concealed. The binding posts are in plain view and the wires may be easily connected by any lineman. They are furnished with either polished brass or nickle finish and the designs are neat and attractive, making them an ornament wherever placed.


THE STAR ELECTRIC FAN.

The motors in the bottom of the drop are very well made and are not liable to injury by the fan being suddenly stopped with the current on. They are wound for 110, 220 and 500-volt direct currents. Special motors for currents of any voltage between 50 and 110 are manufactured, when desired, but are not kept in stock. The wide range for which these fans are manufactured will undoubtedly give them a large sale.

New Voltmeter Switch.

The voltmeter switch, herewith illustrated, has recently been placed on the market by the Electrical Engineering and Supply Company, of Syracuse, N. Y. The instrument is designed to be used in connection with a number of generators in place of the primitive strap switch or the plug method, adopted where the number of circuits becomes too large for the former.

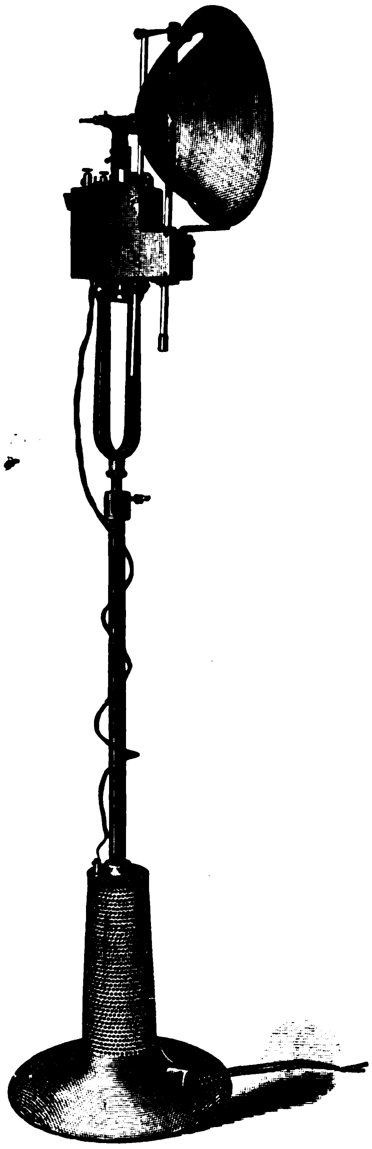

NEW VOLTMETER SWITCH.

They are made in two styles, single and double pole. The arm is brass, of two pieces, insulated and mounted on the central support. A light spring contact piece is carried on the lower side at each end, and as the arm is rotated by the corrugated hard rubber disc at the center, these touch diametrically opposite posts. One contact spring is lengthened to bear on the ring on the base, and by means of this ring and the other arm the voltmeter is connected through the center post. The test wires from the circuit are brought to opposite posts, and by turning the arm the voltmeter may be connected to any circuit or cutout. Stops are provided to prevent the reversing of the current.

The switches are shipped of any number of circuits on wood bases for, templates, or put upon slate or marble bases. While there is nothing especially new in this instrument its adapation to the work for which it is constructed will be readily seen and appreciated.

The Krueger Theatre Arc Lamp.

The lamp shown in the engraving is especially adapted for lighting theatres, halls and public buildings. It takes the place of the calcium light and is superior to it in many respects. It is easier to carry, more reliable, and more economical and at the same time is supplied with a variety of apparatus adapting it for a number of uses.


KRUEGER THEATRE ARC LAMP.

This lamp is equipped with a silvered parabolic reflector that can be quickly and easily adjusted or removed. It is also fitted with a lens box for concentrating the rays of light upon any object on the stage; also an olivette box that is used when a uniform dispersion of light over considerable area is desired which is secured by means of a ground glass front also fitted so that colored glass may be inserted to change the color of the light. The illuminating power of the lamp is equal to 3,000 candles. The regulating mechanism is simple while ingenious by which the intensity of the light is maintained constantly.

The lamp is noiseless in its operation and can be turned in any position without affecting its strength. A rheostat is located in the base of the standard by means of which the lamp may be varied to any desired intensity. The lamp can be connected to any 110 constant potential lighting system, attachments for which are furnished with the outfit. These lamps are already being used by various theatres in Chicago, St. Paul, Pittsburgh, Salt Lake City and San Francisco. They are manufactured by the Western Electric Company, Chicago.

New Meston Motor Outfit.

Two recent adaptations of the one-eighth-horse power Meston motor for alternating currents are shown in the accompanying cuts. The single motor outfit, shown in Fig. 1, is geared with a small rawhide pinion to a countershaft in the proportion of one to nine, giving a maximum speed of 280 revolutions per minute on the countershaft, which is preferable in all cases to belting direct from a speed of 2,500 revolutions on the motor shaft. The motors have been found to be more effective in this way.

Most careful attention has been given to the designing of the countershaft and gearing to transmit the power with the least possible friction. This outfit is supplied with either the hand regulator for varying the speed of the motor and the direction in which it runs, or the foot regulator which accomplishes the same result and by which the motor may be stopped instantly. In Fig. 2 is shown the duplex outfit, consisting of two one-eighth horse power motors coupled to a single countershaft giving double the power of the single outfit. Each motor is supplied with a separate hand regulator for varying the speed, for starting and stopping the motor, and also for reversing the direction of motion. No foot regulators are furnished with the duplex outfits. The motors used in these outfits are the Meston fan motors which have been on the market for about three years, and have given general satisfaction.

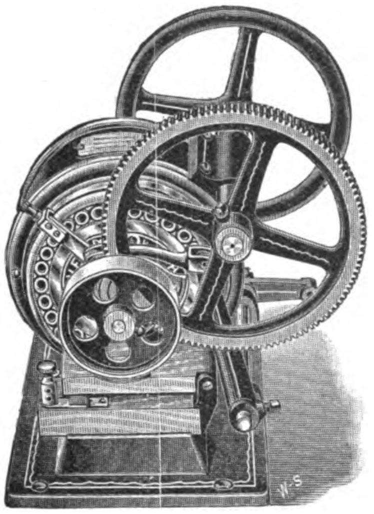


FIG. 1.—NEW MESTON MOTOR OUTFIT.

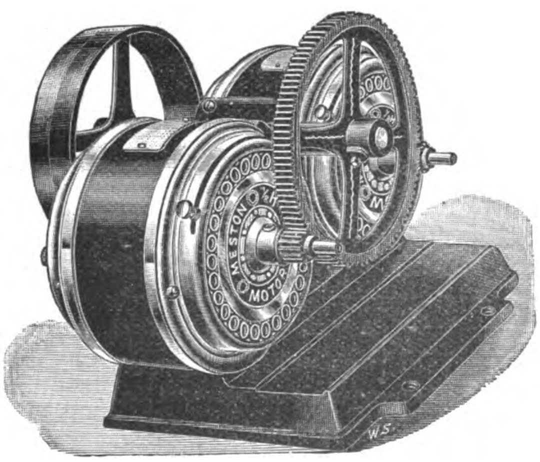


FIG. 2.—NEW MESTON MOTOR OUTFIT.

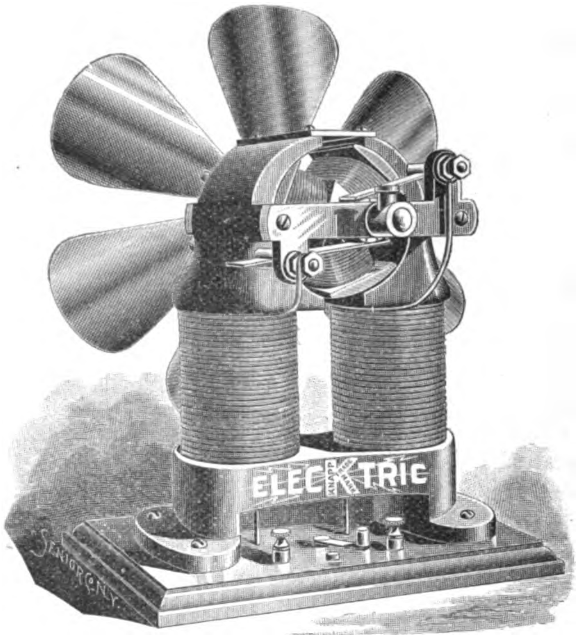
These motors and outfits are manufactured by the Emerson Electric Manufacturing Company. A new alternating dental outfit, manufactured by the same company, will soon be placed on the market. The Electric Appliance Co., Chicago, is the general western agent for the manufacturers.

The Knapp Electric Motor.

In the accompanying illustration is shown one of the motors manufactured by the Knapp Electric and Novelty Company, 34 Warren street, New York, which makes a specialty of motors designed for low potential currents. It is intended to run light machinery such as fans, lathes, etc.

Although of small size the motors are as well made and finely finished as motors of a larger size. It is eight inches high, weighs twelve pounds and requires a current of from four to ten volts. For fan work a good rate of speed is obtained from a four volt circuit and any storage battery may be used or primary battery giving a current consistent with the work to be done. It will be especially appreciated by persons desiring fans or power for running small machines in places where high potential currents cannot be had.

This company also manufactures motors of smaller size with complete fan outfits that can be operated at the cost of a little over one cent per hour. These outfits are supplied with everything necessary to run the fans and with directions for renewing the battery. A pulley is also furnished so that the outfit may be used for supplying power, if so desired. The battery cells are encased in a neat cabinet with cords attached for connecting with the motor. A switch is placed on the motor for starting or stopping the fan. The efficiency of these motors combined with the low prices will undoubtedly give them a large sale.



THE KNAPP ELECTRIC MOTOR.

The New Standard Kennelly Ammeter.

In the accompanying illustration is shown the new standard Kennelly ammeter. This ammeter is manufactured by the Edison Manufacturing Company, New York. It is a strong and very accurate instrument, each instrument being tested at the Edison laboratory and compared with the standards preserved there before leaving the factory.

Excellent workmanship is shown throughout. The mechanism is enclosed in a handsome case, the binding posts are large and strong, the scale is wide, plain, and covers an arc of 125 degrees. The center shaft is mounted in agates to reduce friction. The armature mounted on the center shaft, from which motion is communicated to the pointer, is of disc shape with its windings spread uniformly over the surface. This armature moves between the poles of a flat horse shoe magnet. The poles of this magnet are brought out in a semi-circle, facing each other and separated from each other by about one-sixteenth of an inch. It is well known that a solid anchor ring of steel uniformly magnetized around its circumference has no demagnetizing force and therefore no tendency to alter its magnetism. The saw cut across such a ring introduces an air gap and establishes a demagnetizing M. M. F., equal to the product of the flux and the air gap reluctant. As the air gap broadens and the reluctant rises this back M. M. F. increases, making the magnetic condition of the whole circuit more and more unstable and rendering it more difficult to find a quality of steel that will have sufficient hardness to withstand this demagnetizing influence, while the narrower the air gap the more permanent and stable the magnetic condition must remain. When the current passes through the armature an electro magnetic pull is set up in the plane of the disc urging it to a right hand or a left hand rotation according to the direction of the current. As the disc moves in obedience to this force as many radial wires enter the poles on one side, as may leave it on the other so that the magnetic force corresponding to the current, remains uniform while the retracting force from the spiral springs increases directly with the angle of displacement. In this way the angle through which the disc and attached pointer moves, is proportioned to the strength of the current. The graduations of the scale are nearly uniform.

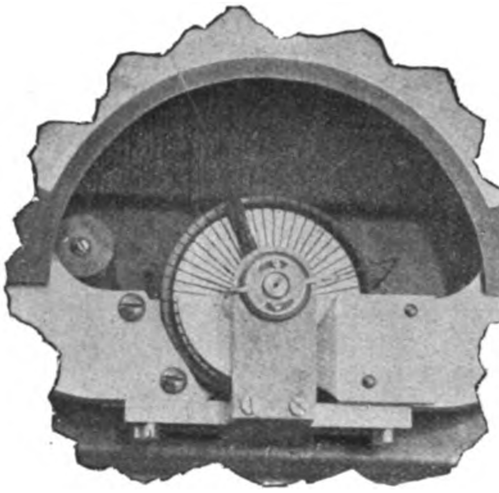


FIG. 1.—NEW STANDARD KENNELLY AMMETER.

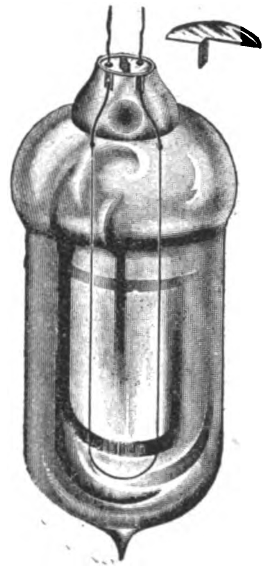
The instrument is very light, weighing about 6 pounds. It is made in any capacity up to 100 amperes.

The New Sunbeam Lamp.

The new lamp shown in the engraving has just made its appearance on the market, and is the invention of John Van der Kammer, of Chicago. The principal feature of the lamp is the use of metal base pieces.

Each of the base pieces has a small projection extending into the lamp to which the platinum wires are attached, that support the carbon filament. These pieces are sealed in the base of the lamp by the glass which also insulates them. By the use of the metallic base pieces, it is claimed, that the all glass receiver and leading in wire features of the Edison patent are eliminated. The globes are filled with gas which is said to be an improvement over the vacuum lamp, in as much as the perfect vacuum cannot be secured, and in the partial vacuum the filament constantly deteriorates, and consequently shortens the life of the lamp. The machinery necessary to make the vacuum lamp is more elaborate and expensive than that required in the manufacture of the gas lamp.

In the adoption of this method Mr. Van der Kammer has followed out the idea employed in the manufacture of the earlier forms of incandescent lamps, the more recent manufacturers of lamps having used the vacuum. The objection to the old form of gas lamp was the difficulty of securing a suitable gas that would not affect the filament and thus destroy the efficiency of the lamp. Another objection found in the gases formerly tried, was that there was a great loss of energy caused by the heating of the gas.



NEW SUNBEAM LAMP.

In the gas employed in the new lamps, however, none of these objectionable features have been found. One of the causes of the delay in putting the lamp on the market has been the difficulty in getting the material for the manufacture of the gas. It is claimed that by its use the filament is protected, so that it is unaffected by the sudden increase of pressure, and for this reason is especially adapted for circuits with varying currents. In the new methods employed in the manufacture of this lamp, the globes may be used over again, and the metallic base pieces are of sufficient size, so that they can be separated from the glass and again used. This lamp is manufactured by the Star Lamp Company, Chicago.

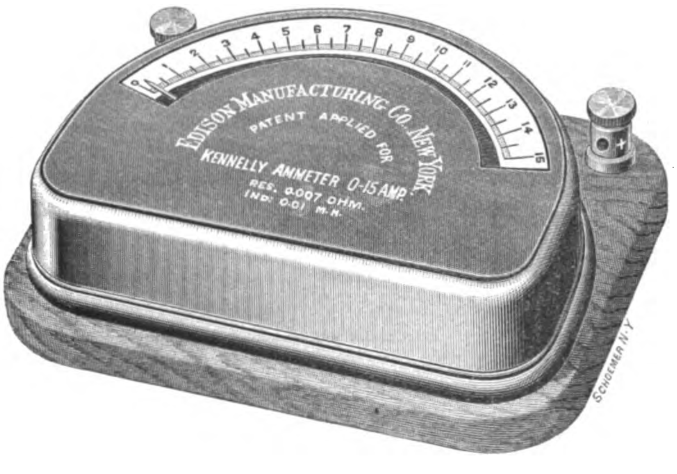
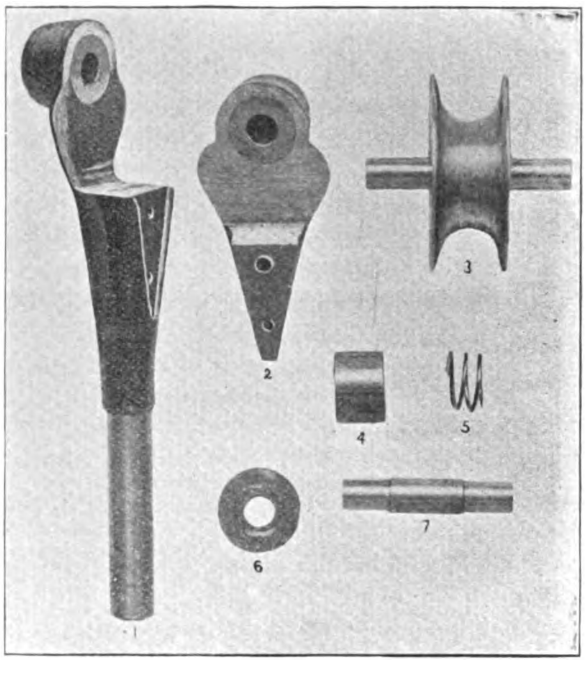


FIG. 2.—NEW STANDARD KENNELLY AMMETER.

The Allen Trolley.

In the accompanying cut is shown a new trolley with its different parts recently patented and put on the market by the Allen Trolley Company, 123 N. Third street, Philadelphia. The construction of this trolley has some quite new and novel features, among which will be noted that the shaft is fastened to the wheel and rests on two self lubricating bearings requiring no oil.

The wheel is made of tempered copper, and the company guarantees 30 per cent. more wear than those made of other metal. The hub of the wheel is hollow, and placed within it is a spiral spring held in place by brass washers on each side of the wheel, thus giving a perfect contact, and as the wheel necessarily runs steady and true it does away, it is claimed, with any danger of an arc. The base or stand is very simple, being a cast iron case containing oil tempered leaf springs with sufficient tension to hold the trolley against the wire. Owing to its extreme simplicity of construction there are few wearing parts to the trolley with nothing to break or get out of place, and at the same time permitting the pole to lean either way.



THE ALLEN TROLLEY.

This trolley is made of a standard size, all parts being interchangeable. Extra parts are kept in stock so that orders are promptly filled.

The General Electric Company's Transformers.

The many improvements in the alternating system within the past few years and its adaptability for the various systems of lighting has made the alternating system a great competitor of the direct current. This advancement is largely due to the perfection of the apparatus used in connection with the alternating current.

In the manufacture of alternating current machinery, the General Electric Company has done much for the perfection and improvement of the transformer which, next to the generator itself, is of the utmost importance in a lighting plant. It is a means whereby a current of high tension, generated at a central station may be converted into one of low tension suitable for the operation of incandescent lamps. On its efficiency and durability depend largely the profits of the station. It has required years of experiment and practice to bring the transformer to its present state of perfection. The essential characteristics of a good transformer are safety and high efficiency, coupled with good regulation and convenience of installation. In the F type of transformer manufactured by the General company, perfect safety is attained by insulation by the best mechanical means with an additional insulation of oil and also by the sub-division of the primary and secondary coils and by the absence of all fuses in the transformer case.

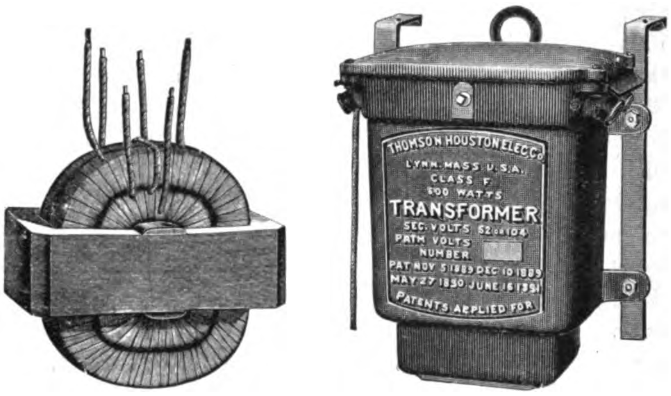


FIG. 1—GENERAL ELECTRIC CO'S TRANSFORMERS.

In the transformers in which oil is used, which is a mineral oil, the coils and the core are entirely immersed, with the result that should the insulation be injured in any way the oil immediately flows in and restores the apparatus to almost its original condition. It is said that in several tests with this style of transformer the voltage has been increased to 11,000 volts before the insulation was broken and after standing a short time the transformer was again tested and the voltage increased to 5,000 volts before the insulation was again destroyed. This type of transformer is also supplied with a core ground wire which serves to render the transformer still more efficient by protecting the system from the disastrous effects of lightning. By the subdivi-

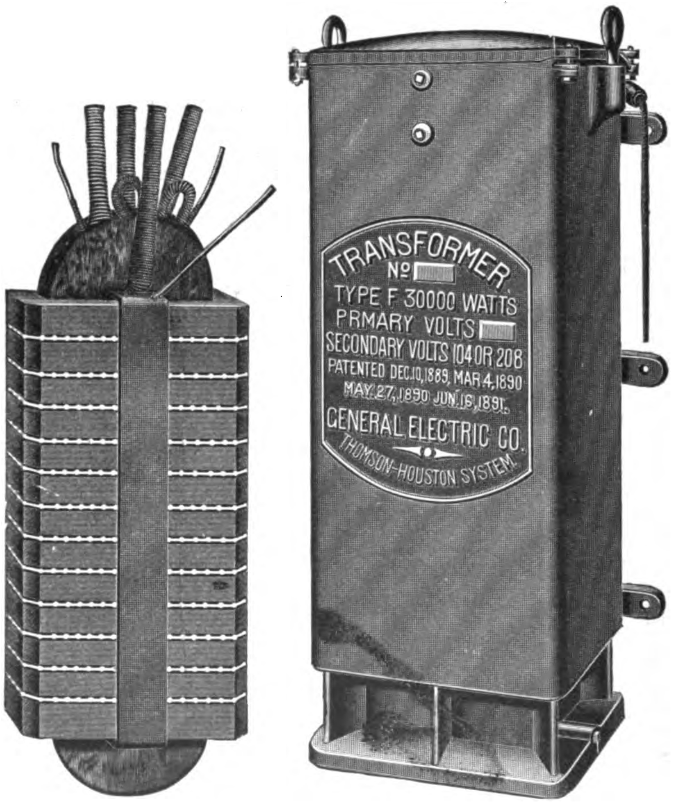
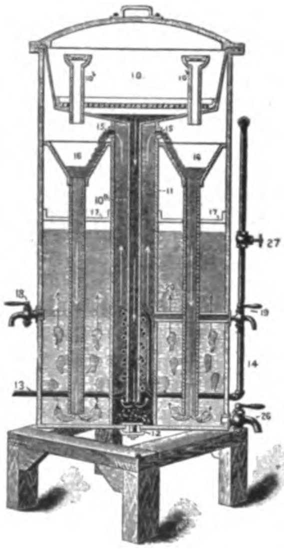


FIG. 2—GENERAL ELECTRIC CO'S TRANSFORMERS.

sion in the primary and secondary coils the difference in potential between any two adjacent coils is reduced to one half the primary voltage. By placing the fuse wires in separate cases all liability to injury by the hot metal of the melted fuse is eliminated.

These transformers have an efficiency varying from 84 per cent in a transformer of 600 watt capacity under a quarter load to 97.2 per cent in transformers of 30 kilowatts capacity under full load. In present practice there is a tendency toward the substitution of one large unit for a number of small ones where the number of lights is sufficient to warrant the step. The idea that the transformation of a large amount of electrical energy in one large piece is dangerous is abandoned. This is due undoubtedly to the excellence of the construction of the larger transformers. Those constructed by the General company are designed for the transformation of 15 and 30 kilowatts. On account of their size the windings are subdivided. In the 15 kilowatts the secondary and primary coils are each subdivided into two parts and in the 30 kilowatt the primary winding is subdivided into three parts and the secondary into two separate coils. In this as in the smaller sizes provision has been made for the free circulation of the oil about the different coils. The advantages derived from the use of the large transformer over a number of small ones are numerous. Small transformers in parallel are apt from various causes to give trouble by dividing the load unequally between them and their combined efficiency is always less than the efficiency of the large one equal to their combined capacity.



TEE EUREKA OIL PURIFIER.

In the system of long distance transmission employed by the General company generators are used which give a potential of about 1,000 volts which by means of transformers is raised to a potential of 5,000 volts or more. This current after being tramsmitted over wires to the distant receiving point is there retransformed to a lighter potential. The transformers used in this system are similar to the above described type. Oil is used as before described and both the primary and secondary coils are wound so as to secure the greatest possible inductive effects without any sacrifice of insulation. Mica is freely used and the greatest care is taken both in the winding and the assembling of the various parts to make the insulation as near perfect as possible. The standard size is 25 kilowatts and larger sizes are made if desired.

The Eureka Oil Purifier.

In the accompanying illustration is shown an oil purifier which has many decided advantages. It is manufactured by the Eureka Oil Purifier Co. of Philadelphia.

The body of the purifier consists of a plain tank of galvanized iron japanned and furnished with burnished brass trimming giving it a very handsome appearance. In the top of the filte risa hopper into which the waste oil is thrown from the bottom of which a pipe extends to nearly the bottom of the tank. All the coarse particles of dirt are collected by a fine wire screen placed over the top of the pipe. From this pipe the oil passes into the well which surrounds this pipe. Here the oil passes over a coil of steam pipe which warms the oil causing it to release whatever foreign matter it may contain, and rises to the top while the dirt is precipitated.

The steam coil may be connected to a pipe direct from the boiler or from the exhaust, as only sufficient heat is required to warm the filter. From the top of this well the oil is led by two ducts to hoppers with pipes extending down into the water at the bottom of the tank. From these hoppers the oil passes down through the pipes and up through the oil water to the top where it is drawn off through the oil faucet. In passing through the well, the gentle heat causes the oil to limber up, and after being washed by passing through the water it is said to be perfectly purified and new oil to be greatly benefitted. The purifiers are substantially made and are so constructed as to be easily and thoroughly cleaned.

Lord's Boiler Compound.

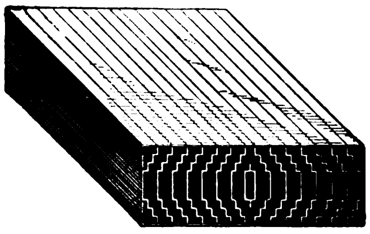
To understand the formation and prevention of scale in boilers requires a knowledge of chemistry not often possessed by the owner of a boiler or the engineer who has charge of it. This fact alone permits various devices and compositions to be sold, representing to be the only thing that will prevent scale in boilers. While they are entirely useless in accomplishing the effect as represented, they are often injurious to the boiler itself.

The owner of the boiler seeing no good results from the use of this so-called scale preventer infers that there is no boiler compound that will accomplish the desired result, a wrong conclusion and one detrimental to him financially. The idea that any one composition will prevent all incrustation and corrosion in all waters is entirely wrong. Water is filled with the impurities common to the locality from which it comes and as the soil is as different in composition in different localities as possible, the impurities in the water are equally unlike. One of the largest manufacturers of boiler compound and one who has a world-wide reputation, is Mr. G. W. Lord of Philadelphia, Pa. Mr. Lord has devoted thirty-five years of his life to the special study of the various impurities found in water and the chemicals necessary to hold them in solution. He is a thorough and practical chemist. In his extended and varied experience he has examined the waters from all parts of North America and from this experience he has been enabled to prepare a compound adapted for each locality. His name is so well known, as the manufacturer of Lord's boiler compound, that he receives samples of water and incrustation from all parts of the United States, for examination with orders for boiler compounds. While Mr. Lord has reached a point of success envied by many, it has not been attained without a struggle. The sale of compositions manufactured by incompetent persons advertised to be equal to the best has tended to injure the reputation of the legitimate article made by him.

Lord's boiler compound has been examined by a great many practical and scientific engineers. In the "Care and Management of Steam Boilers" by Roper, page 118, is the following: "The acids, which cause pitting, honey combing, grooving, etc., held in solution are beyond the reach of any mechanical devise to prevent and can be combated only by a chemical combination such as Lord's compound-"

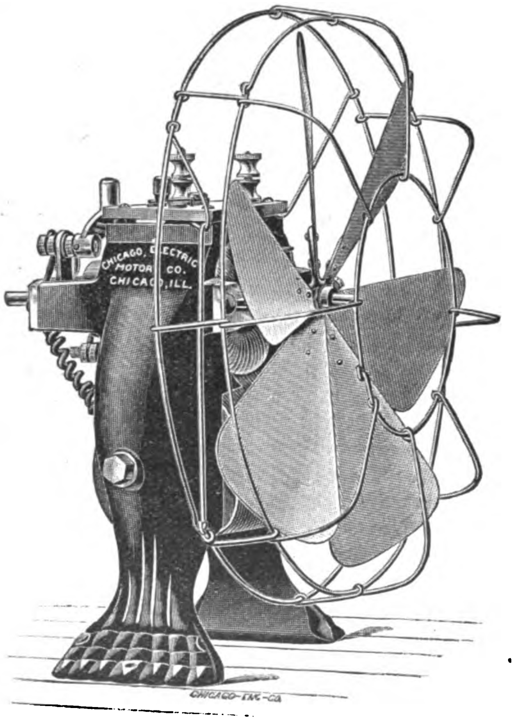
Milwaukee Commutator Brush.

In the accompanying illustration is shown a new brush which has recently been placed on the market by the Wisconsin Electrical Construction Company, Milwaukee, Wis. The white lines on the face and dark lines on the sides show the sections of pure copper deposited electrolytically on strips of composition shown by the black lines on the face and the white lines on the sides of the brush.



MILWAUKEE COMMUTATOR BRUSH.

The exterior of the brush is coated with a layer of copper which binds the parts of the brush in one compact mass. The composition is composed of graphite-carbon and a scouring or cleaning substance. The copper furnishes the conductor, the graphite the lubricant and the scouring substance the cleaning properties of the brush. This brush is the result of three years of practical tests in endeavoring to find a brush that would afford the least resistance to the passage of the current and not wear the commutator but keep it clean and free from foreign substance. The oiling, trimming and adjusting demanded by ordinary brushes is not required, in fact, only a minimum of attention is necessary. It is claimed that with this style of brush, the commutator will last twice as long, while it is always brightly polished, and that there is no sparking at the brush. It is designed for a radial position and cannot be used in the ordinary tangent holder. The manufacturers are preparing a universal holder in various sizes that will fit nearly all dynamos and motors. In ordering brushes it is necessary to state the voltage of the machine for which they are intended, maker's name, size, length, breadth and thickness of brush, number used in each holder and total current used or generated by the machine.


CHICAGO, ELECTRIC MOTOR CO. CHICAGO, ILL.
CHICAGO-ENG-CO

CHICAGO ELECTRIC MOTOR CO.'S FAN MOTOR.

Chicago Electric Motor Company's Fan Motor.

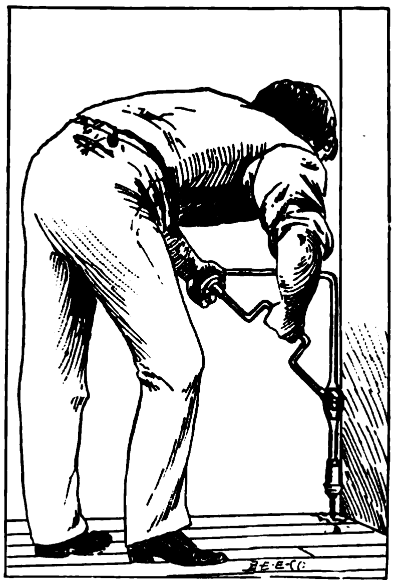
The fan motor, manufactured by the Chicago Electric Motor Company, Chicago, and illustrated in the accompanying cut is just entering on its third year. It has been greatly improved since it was first placed on the market and comes out this year more attractive than ever.

There is no danger connected with the operation of the fan and it may be moved about the room in any desired position. The current required to drive the 12 inch fan, with which the motor is fitted, is about the same as an ordinary 16 candle power incandescent lamp. It may be connected to the wires that supply the incandescent lights or special wires may be run. A very convenient way is to remove the incandescent lamp and insert a plug to which the wires are connected from the motor. The motors are furnished either with or without the three speed switch, by which the speed of the fan may be regulated and which is shown in the illustration. The company expecting a large demand for them has provided a large stock.

The Amidon Corner Brace.

This style of brace shown in the accompanying cut, although not new, deserves mention on account of its points of superiority over all other styles for certain kinds of work. The brace is manufactured by the Amidon Tool Corporation, Buffalo, N. Y. It is well made of steel and finely nickle plated.

While it is of great value to the carpenter and plumber, it is almost indispensable to the bell-hanger and wireman. It supplies the place of the ratchet brace and accomplishes the same result easier and quicker. In boring through floors or partitions, in corners or near the walls or floor, it greatly excels, it is claimed, the ratchet brace on account of the advantage due to the hand moving continuously in the same direction. With the ratchet brace the bit often slips during the backward movement of the brace causing a loss of time and waste of energy.



THE AMIDON CORNER BRACE.

The Westinghouse Company has just completed a large electric power plant in Ponoma, Cal., for transmitting light and power from San Antonio Canon to Pomona, 14 miles distance, and to San Bernardino, 28 miles distance. The plant has been started and runs successfully.

Van Depoele Trolley Patents.

It is announced by the General Electric Company that "after several years of contention and interference before the Patent Office, two broad fundamental patents have been granted to Chas. J. Van Depoele, covering all the essential features of the trolley. The patent is assigned to the Thompson-Houston Electric Company. In detail, the claims allowed cover first, the underneath contact made either by a rolling wheel or a sliding spoon contact piece, secondly, the converse of these two cases, and thirdly, the reversibility of the trolley pole on top of the car enabling the contact to be made on either side of the trolley as the case may be. The possession of this patent practically means, the entire control of the overhead system throughout the United States. This so far is the only system which has proved successful, no serious rivalry having yet been shown, by either the storage battery or the underground conduit. The patent has been and continues to be infringed by several companies. The acknowledgement of the claims under this patent granted to the dead inventor, made by the Patent Office is an important victory for the General Electric Company, which will most likely be followed by very important results to the entire street railway fraternity."

ELECTRIC LIGHT AND POWER.

EXTENSIONS AND IMPROVEMENTS.

Adrian, Mich.—The Electric Light & Power Company will add an incandescent system the present season. J. H. Fee is manager.

Marceline, Mo.—Mr. S. B. Sproule, who recently purchased the electric light plant will install an incandescent system, and add an engine and dynamo.

Binghampton, N. Y.—The Binghampton General Electric Company contemplates adding two engines and boilers, also extensions and general improvements. Geo. W. Dunn is President.

Gloversville, N. Y.—The Gloversville Electric Company will add an engine.

Richfield Springs, N. Y.—The Richfield Springs Electric Light & Power Company is to extend its lines and make a few improvements. J. A. Storer is purchasing agent.

Newport, N. H.—The Newport Electric Company will install a new engine and incandescent dynamos. N. W. Tenney is manager.

Jamestown, N. Y.—The Jamestown Electric Light & Power Company will largely increase its engine and boiler capacity. C. W. Grant is president and purchasing agent.

Charleston, Mo.—The Charleston Electric Company will increase its power by adding a new engine. R. J. Shepard is manager.

Rutland, Vt.—The Rutland Electric Light Company contemplates the addition of another boiler. M. J. Francisco is president and purchasing agent.

Richmond, Mo.—J. R. & O. W. Hammacher will add more power and increase their lines next fall.

Bozeman, Mont.—The Gallatin Light, Power & Railway Company contemplates erecting a new power house. This company succeeds the Bozeman Electric Light Company.

Red Cloud, Neb.—The Red Cloud Power Company contemplates adding a power pumping plant. W. S. Garber is president and purchasing agent.

Mt. Vernon, Ill.—The Mt. Vernon Electric Light Company's plant was totally destroyed by fire March 12th. A new plant will be installed at once. Allen C. Tanner is manager.

Parkersburg, W. Va.—The name of the old Parkersburg Gas Company has recently been changed; under its new charter it is now the Parkersburg Gas and Electric Company. The gas plant is now being rebuilt and as soon as that is completed an incandescent electric light plant will be installed. C. H. Shattuck is president.

Lake City, Fla.—The Lake City Electric Light Company will install an arc and incandescent plant during the season. W. R. Bush is manager and purchasing agent.

Carrollton, Ga.—The Carrollton Electric Company will add an incandescent dynamo. C. R. Turner is manager.

Decatur, Ill.—The Municipal Electric Company will largely increase its lighting and power capacity. E. E. Gibson is purchasing agent.

Natchitoches, La.—A municipal plant may be installed. Address L. Chopin.

Woonsocket, R. I.—The Woonsocket Electric Machine and Power Company will equip its new station with steam and water power for railway use. L. Lincoln is purchasing agent.

Farmington, Wash.—The Farmington Electric Light Company will construct a new power house and install therein a new engine and boiler. Charles Taylor is manager.

Addison N. Y.—F. H. Wheaton proposes to install an arc plant to be in operation Aug 1st. An incandescent plant may be added after that date.

Chester, Ill.—The Chester Light, Water and Ice Company will receive bids on a lighting station. Proposals on the entire work, or any part of it, are asked until May 18th, by Wm. H. Bryan, 56 Turner Bldg., St. Louis, Mo., or at manager's office, Chester.

Nevada City, Cal.—The Nevada County Electric Power Company will install a power plant to drive machinery in mines. Eight miles of double wire will be used. Alfred Tregido is president and manager.

Mobile, Ala.—The Electric Lighting Company of Mobile contemplates increasing its power and extending its lines. H. W. Shields is purchasing agent.

Beatrice, Neb.—The Beatrice Rapid Transit & Power Company will make extensive additions to its present capacity.

Santa Barbara, Cal.—The Santa Barbara Electric Light Company will install a new boiler. A. B. Williams is superintendent.

De Soto, Mo.—The Consumers' Electric Light & Power Company contemplates the installation of an arc machine.

Austin, Ill.—The Cicero Light, Heat & Power Company will add an engine and boilers, also arc and incandescent dynamos. H. P. Lucas is manager.

Algona, Ia.—A municipal plant (arc and incandescent) will be installed this season. A. A. Call is mayor.

Chadron, Neb.—The Chadron Electric Light & Power Company will install an arc light dynamo. J. W. Boyd is superintendent.

New London, O.—The New London Electric Light Company has been granted a street franchise but has not as yet commenced operations.

Plain City, O.—E. H. Malatt advises that the contract for a combined municipal electric light and water works will be let within 90 days.

Sumner, Wash.—The Whitworth College Light Company contemplates an extension of its lines in the near future. M. K. Wigton is purchasing agent.

Clyde, O.—Bids will be received till May 9th noon for a municipal electric light plant according to specifications on file in clerk's office. Address W. E. Gillett, Clerk.

Rutland, Vt.—The Rutland Electric Light Company has secured an injunction against the Marble City Company, restraining it from erecting its poles and wires so as to interfere with the rights and property of the Rutland Company. The decree of the court also provides for the appointment of a master to determine the amount of damages sustained.

THE ELECTRIC RAILWAY.

EXTENSIONS AND IMPROVEMENTS.

Michigan City, Ind.—The Lake Cities Electric Railway Company has let its contract for electric equipment.

Brooklyn, N. Y.—The Atlantic Avenue Railroad Company will re-equip its entire line. Henry R. Newkirk is superintendent.

Niles, O.—The Mineral Ridge & Niles Electric Street Railway Company contemplates constructing eleven and one half miles of additional track. W. T. Williams is manager.

Defiance, O.—The Defiance Light & Power Company will add a generator and boiler, and erect a new power house and car barn. Henry J. Smith is manager.

Athens, Ga.—The Athens Railway Company will install additional motors, construct one mile of new track and add four more cars.

Norristown, Pa.—The Citizens' Passenger Railway Company has contracted for the electrical equipment of its road. Chas. Naylor is superintendent.

Carbondale, Pa.—The Carbondale Traction Company contemplates making several important extensions. W. F. Sadler, Jr., is manager.

Ashtabula, O.—The Ashtabula Rapid Transit Company will double its present capacity throughout. F. B. Wagner is president.

Findlay, O.—The Findlay Street Railway Company will construct about sixteen miles of additional track this year. Charles Smith is manager.

Nashville, Tenn.—The Citizens' Rapid Transit Company is inincreasing its capacity by the addition of open cars. W. S. Jones is manager.

Schenectady, N. Y.—The Schenectady Street Railway Company has contracted for six open cars to be delivered May 1st.

Milwaukee, Wis.—Milwaukee Street Railway Company is making a number of improvements. The new barn will be made larger than the one burned, and as soon as the shops are completed the company expect to build its own cars.

Winona, Minn.—Winona General Electrical Company has purchased the Winona City Railway Company and Winona Electric Light Company, all of which will be under the one management. Various improvements will be made, including a new power house.

Painesville, O.—The Painesville, Fairport & Richmond Street Railway Company has material on ground and will begin at once the construction of its road. The length to be four and one half miles. J. K. Pierson is president and manager.

Akron, O.—The Akron & Silver Lake Railway Company will construct and equip its lines. C. F. Parmalee is interested.

Springfield, O.—The Springfield Railway Company will construct one and one-half miles of additional track and add six open cars. S. L. Nelson is manager.

Waverly, N. Y.—The Susquehanna Valley Electric Traction Company is now constructing and equipping its road. A. N. Broadhead is president.

Concord, N. H.—The Concord Street Railway Company is now constructing one mile of additional track. H. E. Chamberlain is superintendent.

Bozeman, Mont.—The Gallatin Light, Power & Railway Company has recently purchased an engine and two boilers. H. M. Ogden is manager.

Camden, N. J.—The Camden Horse Railroad Company will construct two and one-fourth miles additional track and add an engine and generator. S. J. Fenner is superintendent.

St. Paul, Minn.—The St. Paul & White Bear Railroad Company will construct several miles of additional track, improve its terminals, add to its equipment, and increase its power.

Canton, O.—The Canton-Massillon Electric Railway Company will extend its line to Navarre, Brookfield and Louisville this season. W. A. Lynch is president.

NEW BOOKS.

Engine Room Chat: By Robert Grimshaw, M. E., New York. Practical Publishing Co., 21 Park Row, 1893, 144 pp.; postpaid by publishers, $1.00.

This book, which is written in a very interesting and amusing style, contains many hints for the care of boilers and their repair.

The Measuring of Electrical Currents and other advanced Primers of Electricity, by Edw. J. Houston, A. M., New York. W. J. Johnston Company, Ltd., 41 Park Row, 1893, 429 pages, 169 illustrations. Price: $1.

This book is the second volume of Prof. Houston's series of elementary treatises for students and non-technical readers. It gives the reader a general idea of the principles of electrical measurement and the apparatus with which it is measured, and also the different methods of electric lighting and power with the apparatus in practical use for generating and distributing electricity.

Alternating Currents: An Analytical and Graphical Treatise for Students and Engineers, by Dr. Frederick Bedell and Dr. Albert C. Crehore, New York. Published by the W. J. Johnston Co., Ltd. 325 pp., 112 illustrations; price $2 50.

This book commences with the fundamental principles and theories of electricity and magnetism and gradually advances to the more complex treatment of the alternating current. In the first half it is treated analytically and in the latter half graphically. The book is especially designed for students who can follow the thoughts of the authors, even with a limited knowledge of mathematics. Parts of the book have been published from time to time in different electrical papers and have received favorable comment.

Patentable Invention, by Edward S. Renwick, Rochester, N. Y. The Lawyer Co-operative Publishing Co., 1893, 160 Pages, Postpaid. $2.00

The author of this book, being a mechanical engineer and by his long experience as an expert in patent litigation, is especially qualified to prepare a work which can be understood by a layman and be of assistance to the lawyer in supplying him with the views of an engineer. The book is divided into three parts: Patentable Invention, Invention Patentable by Law, Invention Patentable in Reissue Patent. It is written in a clear, concise and readable style and the subject is set forth in such a way that the engineer or mechanic can determine whether the device which he has constructed is patentable, or if the patent he has received is defective, how, and for what reason, he can secure a reissue patent. The large number of cases cited make it valuable as a book of reference.

TRADE PUBLICATIONS.

The Backus Water Motor Company, Newark, N. J., has just issued a catalogue of its fans and water motors. The catalogue shows fans and exhaust wheels in various designs and styles with attachments and devices for transmitting motion to the fans. It contains also instructions for putting up fans and attachments with prices of same.

O. D. Pierce & Company, 806 Walnut St., Philadelphia, have just issued a very complete catalogue of the specialties which they handle. These specialties include nearly everything manufactured and sold by an electrical supply house. The book consists of 104 pages and cover and is well printed on good paper. The firm deserve much credit for this excellent catalogue.

The tenth annual catalogue and price list just issued by the Electric Gas Lighting Company, 195 Devonshire St., Boston, Mass., is one of the most complete publications of its kind yet published. It is compact in its subject matter and complete in every detail, the book being artistic and showing plainly its careful preparation. The company has achieved a world-wide reputation for the excellenceof its specialties which include the wellknown Samson battery, battery supplies, wires, cables, telegraph instruments, motors tools, push buttons, cut outs, etc.; everything of the sort being handsomely illustrated in detail in this catalogue. Annunciators, which are also one of its leading specialties, receive their share of attention. The descriptions of the different articles enumerated reflect much credit upon the company.

A catalogue has recently been issued by the Curtis Electric Manufacturing Co., Jersey City, N. J., of the street railway motor and other street railway supplies which it manufactures.

The Hoppes Manufacturing Company, Springfield, O., has just issued a new catalogue descriptive of its purifiers. It contains a number of engravings of purifiers recently manufactured for some large boiler plants, as well as of a number of purifiers that have been used for some time showing the collection of impurities from the feed water. The method of connecting the purifier separate and combined with Hoppes exhaust heater is also shown.

Something decidedly new in the way of a catalogue has just been issued by the Ansonia Electric Company, Chicago. The catalogue comes from the fixture department and consists of heavy cloth covers, 12x15 inches, in which are bound short linen stubbs to which the plates are attached, descriptive of the various styles and kinds of electric and combination fixtures manufactured and supplied by thiscompany. This style of catalogue has been adopted in order that as fast as new designs of fixtures and attachments are placed on the market, plates may be issued illustrating the new designs, which can easily be fastened in the catalogue with those already issued.

PERSONAL.

Capt. Willard L. Candee of the Okonite Company paid Chicago a short visit during April.

Mr. Morris W. Mead, secretary of the Bureau of Electricity, Pittsburgh, was in Chicago for a few days last month.

Mr. E. P. Roberts, general manager of the Swan Lamp Company, Cleveland, O., was in Chicago for a few days last month.

Mr. David W. Dunn, general manager of the Austin Engineering Company, Pittsburgh, paid Chicago a brief visit last month.

Mr. Chas. N. Black has recently been promoted by the Brush Electric Company to the position of assistant superintendent.

Mr. Charles Edward Brown of the Central Electric Company is receiving the congratulations of his friends upon his engagement to Miss Katharine Graves.

Mr. Frank B. Rae, Detroit, was among the visitors to Chicago a short time since. Mr. Rae is consulting engineer for the city of Detroit which is considering the advisability of putting in a municipal lighting plant.

Mr. Robert Johnson, prominently connected with several manufacturing companies of Springfield, O., was recently elected vice-president, and Mr. J. A. Hayward, formerly a prosperous lumber merchant, treasurer of the Hoppes Mfg. Company of Springfield, O.

Mr. Henry C. Townsend, New York, has associated with himself Mr. Delbert H. Decker, recent assistant examiner in the division of electricity U. S. patent office, who will have charge under his immediate direction of the business relating to the soliciting of patents.

Mr. F. A. Scheffler who is well known to the electrical fraternity and who resigned his position May 1st as general superintendent of the Brush company, has just accepted the position of general sales agent of the Stirling Company with office at 74 Cortlandt st., New York City.

Mr. Louis W. Burnham, vice president and general manager of the Electric Gas Lighting Company, Boston, visited Chicago for a few days last month. The success of this company is due to the individual efforts of Mr. Burnham and he may well feel proud of its present prosperity.

Mr. L. H. Rogers, of Boston, Mass., has been appointed assistant general manager of the Brush Electric Company, and will hereafter reside in Cleveland. Mr. Rogers was at one time connected with the New York office of the Brush Company, but has for some time been with the General Electric Company.

Mr. Chas. W. Phipps, who has recently been appointed superintendent of the Brush Company, has earned a well-deserved reputation for bravery. While in Japan in the interests of the Brush Company he rescued several sailors in the bay of Yokohama and in New York city during a storm he rescued a lineman from the arc light post at the corner of 6th avenue and 33rd street. Mr. Phipps has grown up in the Brush company's employ, and his recent appointment is but a deserved recognition of the ability and push which he has shown in his extended experience with Brush apparatus.

BUSINESS NOTES.

The Wm. Powell Company, Cincinnati, O., is erecting a new plant, the power for which will be furnished by an 80-horse power Jenney motor.

Commercial Electric Company, Indianapolis, is putting a 250 light generator in the headquarters of the Wellington Catering Company at the World's Fair.

Taylor, Goodhue & Ames, who are pushing the sale of the Wagner motors and Burton heaters have just moved from the Monadnock Bldg., to their new quarters at 348 Dearborn Street.

The Caldwell Boiler Company, 15 Cortland Street, New York, has been awarded the contract to install 455 horse power of boilers in the New York building, corner of Broadway and Dey Streets.

The General Incandescent Arc Light Company, 59 Duane Street, New York, has opened an office and salesroom at 169 Adams Street, Chicago, with Mr. L. C. Frorup as western representative.

S. Freeman & Son, Racine, Wis,. have recently purchased a tract of land on the north side of the river for $8,000, on which they expect to erect a new boiler shop for the accommodation of their growing business in this line.

The Consolidated Car-Heating Company, Albany, N.Y., report the sale of its heaters to a number of important electric roads. The Union Railway in New York City has 270 in its cars, and the Albany railway is using 96 of the heaters.

The Pope Mfg. Co., Boston, Mass., has just issued a little book of 80 pages on various out-door sports, called Out-Doors. The book contains interesting articles on lawn tennis, yachting, canoeing, cycling, foot-ball, etc., by popular authors.

The Akron General Electric Company, has been awarded the contract for lighting the streets of Akron, Ohio. The contract price for lighting was three cents per lamp hour for all dark hours, or an estimated cost of $75 per lamp per year.

The Fitchburg Steam Engine Company, Fitchburg, Mass., has built for the Chicago Beach Hotel one 300 and one 200 horse power tandem compound condensing engines. The engines are connected to Brush dynamos by rope transmission.

The Jenney Motor Company, Indianapolis, Ind., comtemplate the erection of a new shop, joining the present one, 120 feet by 40 feet. The new shop will be fitted up in accordance with the latest deas of modern electrical and mechanical engineering.

Geo. Cutter, 851-855 Rookery building, Chicago, has found the old quarters too small to handle his growing trade, and can now be found at the above address. He has also been obliged to secure additional storeroom to accommodate his stock of electrical specialties.

The Westinghouse Electric and Manufacturing Company has secured what is said to be one of the largest contracts ever made for street railway apparatus. This order is from the Atlantic Ave. Railway Co., Brooklyn, and amounts to nearly one million dollars.

The Southern Pacific Railroad is to test the practicability of the storage battery for lighting trains. It is reported that the Texas Mexican Electric Light Company has contracted to furnish a car with lamps and storage batteries which are of a pattern recently patented.

The Joseph Dixon Crucible Co., Jersey City, N. J., is distributing a large number of free samples of Dixon's Ticonderoga Flake graphite with its pamphlet describing the nature and peculiarities of graphite with opinions of scientific and practical engineers as to its value as a lubricant.

The Consolidated Electric Co., Chicago, has succeeded the Chicago Incandescent Light & Wiring Company, and will occupy the store of the old company on Franklin st. The officers of the new company are, L. B. Scott, president, C. P. Emmonds, vice-president, C. Oskamp, secretary-treasurer.

The Vilter Manufacturing Company, Milwaukee, Wis., has erected a new plant and equipped it with the most approved machinery for the manufacture of engines and ice-making machines. For the past six weeks the plant has been in operation night and day and Mr. Vilter reports that the output largely exceeds that of the old works.

The Central Electric Company, Chicago, is having a large trade in Okonite wire and Interior conduits as well as its porcelain specialties. Its new socket recently placed on the market is meeting with favor and large sales are already reported. The demand for pins and brackets has been so great as to keep the factory running night and day.

McLean & Schmitt, Chicago, recently bought out the Pioneer Armature Works of that city, and report a flourishing business. They do a general contracting business also and are at present completing a 125 arc plant for the Jno. York store. Mr. McLean has also the supervision of the exhibit of the Excelsior Electric Co., of New York, at the World's Fair.

The Iona Manufacturing Company, Boston, Mass., has just removed its factory to much larger and more commodious quarters at 336 Congress street. The capacity of its factory will be nearly doubled, which will enable it to meet promptly the large demands for its electrical supplies and specialties. The affairs of the company are ably managed by Mr. N. Marshall.

The Keystone Electric Company, Erie, Pa., has just broken the ground for a new factory 50 feet by 100 feet. The new building is to be wholly of brick two stories high with engine and testing room in a separate building 45 feet by 36 feet. It is expected to have the factory ready for occupancy July 1st, at which time the company will be prepared to build dynamos and motors up to 100 horse-power.

The Phoenix Iron Works Company, Meadville, Pa., reports a recent sale of two 300 horse power Dick & Church tandem compound engines to the Saginaw (Mich) Power Company. These engines will each be coupled direct to a 200 kilowatt generator; also a sale to the Wyandotte & Detroit River Railway of one 150-horse power engine, and has closed a contract for eight horizontal tubular boilers for the street railway plant of Allentown, Pa.

Wm. W. Nugent, Chicago, who has had a long and successful experience as contracting and consulting engineer for steam power plants, has succeeded J. M. Hayes as western manager of the C. & G. Cooper Company of Mt. Vernon, O. This company is a large manufacturer of Corliss engines, and Mr. Nugent will no doubt meet with good success in pushing sales. His office will remain at 823 Home Insurance building.

The Buckeye Electric Company, Cleveland, O., announces that it has re-opened its factory and is now prepared to make prompt shipments of "Buckeye" lamps. Mr. J. H. Cooke, the western agent of the company, stated a few days ago that during the past 48 hours he had received orders for several thousand lamps. Consumers, he says, once getting the white light and unusual lighting effect of the coiled filament seem to prefer it thereafter.

The Charles E. Gregory Co., 47 & 49 South Jefferson street, has been very successful in its line of the electrical business, which embraces the purchase, sale and exchange of reliable dynamos, either new or those which have seen some service, the furnishing of complete plants for temporary work, and the general jobbing of electrical merchandise. In nine months of the year 1892 Mr. Gregory installed 192 dynamos and motors, and expects even larger sales for 1893.

The Chicago Insulated Wire Company has been reorganized with the following officers: Edward Carroll, Leavenworth, Kansas, President; T. C. Turlay, Chicago, Vice President and General Manager; Wm. Smith, Sycamore, Ill., Secretary and Treasurer. The company has purchased the plant at Sycamore, Ill., originally operated by the old Chicago Insulated Wire Co., and later by the Great Western Electric Supply Co. Its Chicago office is at 214 Northern Building.

Calumet Electric and Manufacturing Company, Chicago, is constructing a 1,500 light dynamo for the Hub building, corner of State and Jackson streets, Chicago. A one-horse power 500-volt motor has been installed and an eight-horse power 500-volt motor is being constructed for the Mines and Mining building at the Columbian Exposition building. A large number of fan motors designed for 110 and 500-volt circuits, are being constructed at the factory to fill recent orders.

The Ball Engine Company, Erie, Pa., has recently constructed engines for the lighting plants on the four large lake steamers, built by the F. W. Wheeler Company at Bay City, Michigan, these steamers are said to be the largest on the lakes, also two 150-horse power Ball tandem compound condensing engines for the Almeda Street Railway Company, Almeda, Cal., and three cross compound engines of 100, 150 and 200-horse power for the Everett Street Railway Company, Everett, Wash.

The Racine Hardware Mfg. Co., of Racine, Wis., has just shipped the last of the fifty electrical launches for use at the World's Fair, having turned them out on a little more than one month's notice. It also furnishes the automatic turnstiles for the Fair. This company we are advised by its Mr. Reynolds will enter the electrical field in earnest, having just completed a dynamo with a capacity of 50 lights for an isolated plant. The regular line, when made up, will include the various sizes of dynamos up to 300 light capacity.

The Standard Underground Cable Company, Pittsburgh, is to be congratulated upon having recently secured from the Philadelphia Traction Company what is claimed to be the largest contract ever let for a complete underground system in the United States. This contract includes all cable to be used by the Philadelphia Traction Company for the next twelve months, and will amount to between $250,000 and $300,000. All the incandescent lights in the World's Fair buildings are supplied with current through the cables made by the Standard company.

The Ansonia Electric Company, Chicago, are already filling orders for the new Sunbeam incandescent lamps. The rush of orders, as soon as it was known that the new lamp was on the market, has kept the factory at work night and day in the endeavor to keep up with the orders. The company is pushing the sale of the Wirt indicator and the Wirt dynamo brush to the front with success. Its railway department has equipped during the last three months over 300 miles of electric railway with over head constructing using the appliances of its own manufacture.

The Railway Equipment Company, Pullman building, Chicago, has opened a World's Fair bureau for the benefit of its many friends and acquaintances. A register will be kept that will contain the date of the expected arrival, the announcement of the arrival and the temporary Chicago address of its friends. The central location of its offices which are nearly opposite the new Art building, where the World's Fair congresses will be held, and but a few steps from the down town station of the Illinois Central railroad and the steam boat wharf where passengers will be received for the Fair grounds, will undoubtedly make it a favorite headquarters for electrical people.

The Commercial Electric Co., Indianapolis, has recently placed a 15-horse power, 500 volt motor with the Vienna Baking Co.; a 20-horse power, 500 volt motor with the Ansonia Electric Co., and a two horse-power, 110-volt with Siegel, Cooper & Co., all of Chicago. This company has also arranged with the following well-known electrical supply and construction houses to act as agents: E. G. Bernard & Co., Troy, N. Y.; F. A. Swan, Boston; Jones Bros., Cincinnati; W. D. Graves Electrical Mfg. Co., Cleveland; Bissell & Dodge, Toledo; Electrical Engineering Co., St. Louis, and the Southern Engineering Co. at Louisville, Ky.

The Electric Appliance Company, Chicago, has completed arrangements to represent Diehl & Company in the west, handling a full line of ceiling and exhaust fans for direct incandescent, street railway or arc circuits. It has already secured a number of contracts for fans for Chicago stores and restaurants, among which is the contract, recently completed, for the equipment of the Peacock annex of the Boston Oyster House. A new consignment of O. K. Weatherproof wire has been received so that all orders will be promptly filled from the Chicago stock. A number of improvements have been made in the Acme socket which are appreciated by the trade, as shown by the increasing demand for these goods.

The Hotel Cadillac, located at the corner of State st. and Peck Court, Chicago, will be the headquarters for a great many electrical people during the World's Fair. The proprietors of this hotel, Messrs. C. L. Pierce and Louis F. Allardt, are both well known in electrical circles, and it is their aim to make the Cadillac a family hotel, especially for the members of the profession. The Cadillac is located on twelve direct routes to the Fair grounds, and is within three blocks of the new depot of the Illinois Central R. R. Rates are reasonable, and rooms can be secured in advance by letter or telegram. To insure the comfort of their guests both Mr. Pierce and Mr. Allardt will reside in the hotel with their families. The rooms are exceptionally light and airy, and the transportation facilities are of the best to every part of the city.

The Ball Engine Company, Erie. Pa., has recently shipped over 3,000 horse power of engines, as follows: Western Light & Power Company, Chicago, Ill., one 300-horse power simple engine; T. H. Electric Light & Power Company, Quincy, Ill., one 350 horse power cross-compound; Ann Arbor Electric Light Company, Ann Arbor, Mich., one 300-horse power cross compound; Tampa Street Railway Company, Tampa, Fla., one 200-horse power cross compound; Water, Light & Power Company, Nebraska City, Neb., one 100-horse power tandem compound; Niagara Falls Street Railway Company, Niagara Falls, N. Y., one 130-horse power simple engine; Pennsylvania Salt Manufacturing Company, Natrona, Pa., one 70-horse power simple engine; Shoenberger & Co., Pittsburg, Pa., one 80-horse power simple engine; Gallatin Lt. Power & Railway Company, Bozeman, Mont., one 150-horse power simple engine; Hotel Plaisance, World's Fair, Chicago, one 100-horse power simple engine; Cienfuegos, Cuba, one 60-horse power simple engine; Intermountain Electric Company, Salt Lake City, Utah, one 130-horse power simple engine; W. H. Kiblinger, Auburn, Ind., one 125-horse power simple engine; Cohasset Electric Company, Cohasset, Mass., one 80-horse power simple engine.

The Hoppes Mfg. Company, Springfield, O., report the prospects for a lively trade in feed water purifiers, and among its recent sales, the following: One 60-horse power purifier to The South Bend Gas Light Co., South Bend, Ind. One 125-horse power purifier to The Cibolo Creek Mill & Mining Co., Shafter, Texas. One 625-horse power purifier to the Claremont Abattoir Co., Baltimore, Md. One 150 horse power purifier to The West Chester (Pa.) Cold Storage and Ice Co. One 100-horse power purifier to The Garside Mfg. Co., Peoria, Ill. One 500-horse power purifier and one 400 horse power exhaust steam water-heater to The Sandusky (O.) Portland Cement Co. One 350 horse power purifier and one 350-horse power exhaust steam-feed water heater to Wm. Sellers & Co., Philadelphia, Pa. Two 200 horse-power purifiers to The Bay City Union Ry. Co., West Bay City, Mich. One 300-horse power purifier to National Smelting & Refining Co., Chicago, Ill. One 200-horse power purifier to The Hudnut Co., Pekin, Ill. One 500-horse power purifier to The Delaware Electric Light & Power Co., Delaware, Ohio. One 250-horse power purifier to the Richwood Distillery Co., Milton, Ky. One 625-horse power purifier to The Edison Illuminating Co., Monmouth, Ill. One 200-horse power purifier to The Hutchinson Cooperage Co., Peoria, Ill. One 150-horse power purifier to the Peoria Cooperage Co., Peoria, Ill.

The Pullman's Palace Car Company reports the following orders in its construction department: Three closed cable grip cars (double truck), for the Central Traction Company, of Pittsburg, Pa., two open motor cars, for the Kankakee Electric Railway Company, Kankakee, Ill., twenty-six closed motor cars and sixteen open trail cars for the Chicago North Shore Street Railway Company, Chicago; ten open trail cars for the Cicero & Proviso Street Railway Company, Chicago; four closed motor cars for the Galesburg Electric Motor & Power Company, Galesburg, Ill.; six closed motor cars for the Kingston City Railroad Company, Roundout, N. Y.; one double deck centre vestibule motor car for the Sandusky, Milan & Huron Electric Railway, Sandusky, O.; thirty-one open motor, twelve closed motor and seventeen open trail cars for the Detroit Citizens Street Railway, Detroit; two first-class passenger coaches for the Western New York & Pennsylvania Railroad Company; three passenger coaches and one combination passenger and baggage car for the Cleveland, Canton & Southern Railroad; twenty-five passenger coaches for the Central Railroad of New Jersey; three first-class passenger coaches, one combination car and one baggage car for the Baltimore & Ohio Railroad Company; one first-class passenger coach and one baggage car for the Philadelphia & Reading, and one first-class passenger coach for the Central Railroad of New Jersey, all for service on the Royal Blue Line; one private car for the Atchison, Topeka & Santa Fe Railroad; twelve passenger and baggage, six baggage and mail and one mail car for the Chicago & Northwestern Railroad Company; two first-class passenger coaches for the Old Colony Railroad Company; five hundred box and three hundred coal cars, for the Ohio & Mississippi Railway Company; one thousand coal and one thousand box cars for the Norfolk & Western Railroad Company; two hundred and fifty drop bottom gondola and two hundred and fifty plain gondola cars for the Pittsburg, Shenango & Lake Erie Railroad Company.

ELECTRICAL INDUSTRIES.

Vol. IV. NEW YORK. June, 1893. CHICAGO. No. 6.

The Electric Fountains at the World's Fair.

It will doubtless be the verdict of the majority of the visitors to the great Fair, that the most interesting objects, from a spectacular point of view, were the electric fountains designed by Mr. Stieringer. The first fountain of the kind was operated in 1884 at the Healtheries Exposition, London, and was designed by Sir Francis Bolton.

The same type was afterwards used at other London Expositions and at Glasgow, and a similar type was used at the Paris Exposition of 1889. It was introduced in the United States at Staten Island and later the same fountain was brought to Lincoln Park, Chicago, where it still remains. When the question of electric fountains at the World's Columbian Exposition came up Mr. Luther Stieringer the consulting electrical engineer, was called in and the subject thoroughly canvassed. It was finally decided that the proper location was flanking the beautiful MacMonnies fountain at the head of the great basin. There was at first an idea that the electric fountains might in some manner detract from the effect of Mr. MacMonnies creation, but far from doing so, they add much to its attractiveness by blending the lights.

ELECTRICAL-INDUSTRIES

VIEW OF FOUNTAINS FROM ELECTRICITY BUILDING—OPENING DAY.

The engineering and construction of the fountains proper were carried through to completion in a very thorough manner and at a cost in time and material much less than any heretofore erected. The first plan was to sink an iron tank 60 feet in diameter, that being the diameter of the basin of each fountain, to eight or nine feet below the water level, but the trussing and weighting down, together with the framing necessary to support the upper works was found to be so heavy and costly that the whole plan was abandoned.

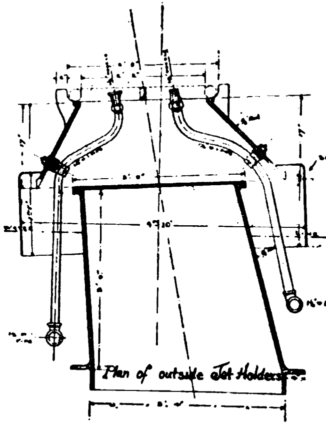
The construction of the basin was done by General Fitzsimmons the well known caisson and tunnel builder. Heavy piles were driven in the ground covered by the basins, some were left long to support the basin proper, others cut off at the level of the submerged chamber. The bottom or shorter piles were secured together by a heavy crib-work of timbers which, being heavily concreted, formed a solid foundation and a good floor for the submerged chamber. The exterior or surrounding shell is made in

Wakefield, sheet piling in three layers, three inches thick each, of plank twelve inches wide and 20 feet long; all joints lapped and thoroughly sand jetted, the whole chamber thus being watertight. Suitable drainage sumps are provided and the whole structure is so trussed and braced as to equalize all exterior and interior strains.

The entrance is at the west side of each chamber, the ceiling of which is high enough for the operators to have plenty of head room; it also provides an approach for the numerous water pipes and electrical conductors.

Each basin is supplied with water at 100 pounds pressure through a 24-inch main directly from the pump house independent of all other pipes, separated at the fountains into two branches 16-inches in diameter ending in a short vertical air chamber to help in the pulsating and water-hammer effects. Vertical feed pipes most of them six inches in diameter rise from the 16-inch headers for supplying the different sections of the fountain. The full water supply for each fountain is controlled by a 16-inch gate valve in the fountain each of the vertical branches being controlled by a lever gate valve allowing quick action. Safety valves and overflows are provided forexcessive pressure.

The water piping and supply for each basin comprises the following: an outer circle of 12 wheatsheaf rings, each containing 116 holes one-eighth inch diameter; an inner circle of six small geyser rings containing seven holes each, five-eighth inch diameter and another similar ring in the center. In the center is the great geyser, a nozzle two-inches in diameter and capable of throwing a stream 150 feet high. Surrounding this is a curtain ring having about eighty one-quarter inch holes. There are 12 nozzles one and one-half inches in diameter called pulverizers located on the outer edge and 18 nozzles one and one-quarter inches in diameter for small geysers and parabolas in each of the 18 wheatsheaf and small geyser rings. All these groups and circles are controlled by the valves in the risers below. Each of the 19 composite groups in each basin is provided with a powerful electric arc lamp having a large silvered reflector. Each lamp will take not less than 80 amperes of current and will throw a beam of light estimated at 220,000-candle power.



JET HOLDER FOR ELECTRIC FOUNTAINS.

FIG. 2.—CROSS SECTION SHOWING OUT SIDE CONSTRUCTION OF JET HOLDERS.

This arc lamp deserves more than passing mention as, while it is a clever modification of the standard marine search light manufactured by the Thomson-Houston Electric Company, it is entirely new in that it is automatic in its action. For use in these fountains it was necessary to have the axis of the carbons in a horizontal plane instead of vertical or slightly inclined as usual. The carbons are secured to a short piece of brass tube which is then clamped into the carbon holder; this not only allows of considerable leeway in adjustment but carbons can be consumed much closer than in the old way. The carbon holders are arranged on a horizontal guide rod to keep them in line and underneath this and parallel to it is the feeding screw having a single left hand thread on one end carrying the negative holder and a double right hand thread on the other end carrying the positive holder, thus allowing the latter to be fed twice as fast as the former and keeping the arc in the center of the reflector.

Screws are provided for adjusting the lamp in any direction and for the adjustment of all its parts. The lamp being operated on a constant potential circuit needs for a feeding mechanism only a shunt around the arc with proper lever, pawl and ratchet wheel and bevel gears for imparting motion to the above mentioned screw. A correct description of the interior mechanism of this lamp is not now nor has it been available. The carbons used are, positive, one-inch diameter cored; negative, three-quarter inch solid, both being without copper coating.

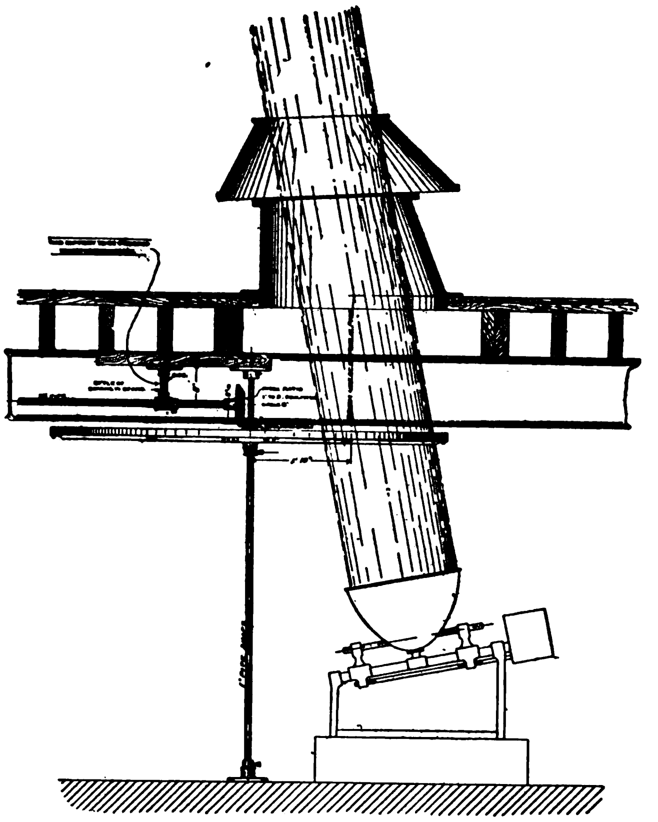


FIG. 3.—CROSS SECTION SHOWING RELATIVE POSITION OF LAMP, SCREEN AND JETS.

Electric current at 240-volts pressure is supplied by the four belt driven bi-polar General Electric generators installed in Machinery Hall and the circuits from them are carried to the operating switchboards in the side chamber of the fountains by the regular Edison three wire tubing. The operating switchboards are provided with all the necessary voltmeters and ammeters for testing both sides of the three wire system; a rheostat for regulating the current to each lamp and proper switches for throwing the lamps on and off. Safety fuses are grouped on the back of the boards.

One of the most important features is the arrangement of the color screens; in former fountains, the screens have been separate, and it was necessary to slide each frame individually into place as changes were required and the effects were therefore not so perfect as could be desired. Mr. Stieringer has designed a very ingenious mechanism by which the screens can all be operated at once and at any desired speed. The six colors, sea-green, green, yellow, blue, ruby and plain white are arranged in fan shaped blades which are joined in a disk on a vertical central shaft which is geared to line shafts leading to the operating room. The glass in each screen is cut into strips to avoid trouble from expansion, and the frames are also braced with wires. These color screens revolving in a horizontal plane can thus be brought successively between the light and water, and the combinations thus obtainable are practically countless. As will be seen by the cuts, the arc light projector is placed on the floor of the submerged chamber, and the beam of light directed upward at a slight angle from the vertical through the color screen, and thence through the jets of water, the pipes being so curved as to bring only the jet itself in line with the light.

The controlling or directing station is in the north-east tower of Machinery Hall and is supplied with a signaling board and table, also with supplemental telephone connection to the operating chamber of each fountain. All signals for changes of jets and colors are sent out to the operators from this directing station, and the arrangement of apparatus for the purpose is very ingenious and complete, consisting as it does of a valve signaling box similar to those used in the navy, together with indicators showing the number of jets in operation, with a light indicating the screen color in use with it, also an indicator showing the number of valves opened. The operating chambers are provided with the proper annunciators showing the colors required and the jets to be operated at any instant. The whole arrangement is wonderfully simple and complete, and as Mr. Stieringer says, could easily be arranged to operate automatically if desired. Former fountains have used only a fractional part of the light that is in use here; the first Bolton fountains using a score or so of ordinary arc lights, and the Paris fountain of 1889 but 17 arcs of 60 amperes each and 30 of 40 amperes. In addition to the powerful projectors in the fountains themselves, there are also concentrated on the water several very powerful search lights.

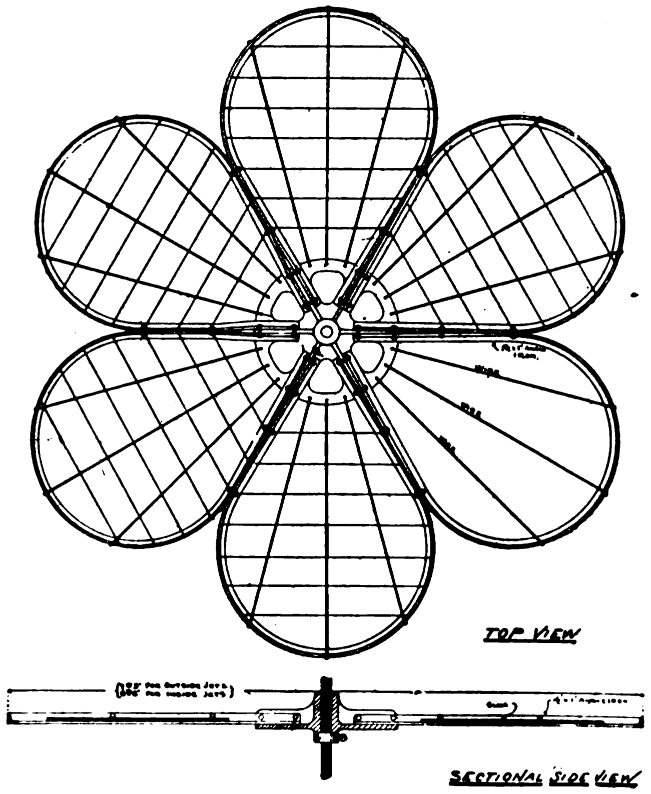


FIG. 4.—PLAN OF COLOR SCREEN.

A word about the pumps for supplying the great quantity of water necessary for this work. On the south side of Machinery Hall is located the pump house and exhibit of Henry R. Worthington, which supplies water for the entire Exposition. There are shown in this exhibit the four principal styles of pumping engines made by this firm, and all are arranged to pump into one large main, but the large vertical pump is assigned for the special duty of supplying water for the electric fountains when not necessarily used on other duty. This pump is a steeple compound low duty machine,, and in extreme height is 51 feet; the daily pumping capacity is 15 million gallons.

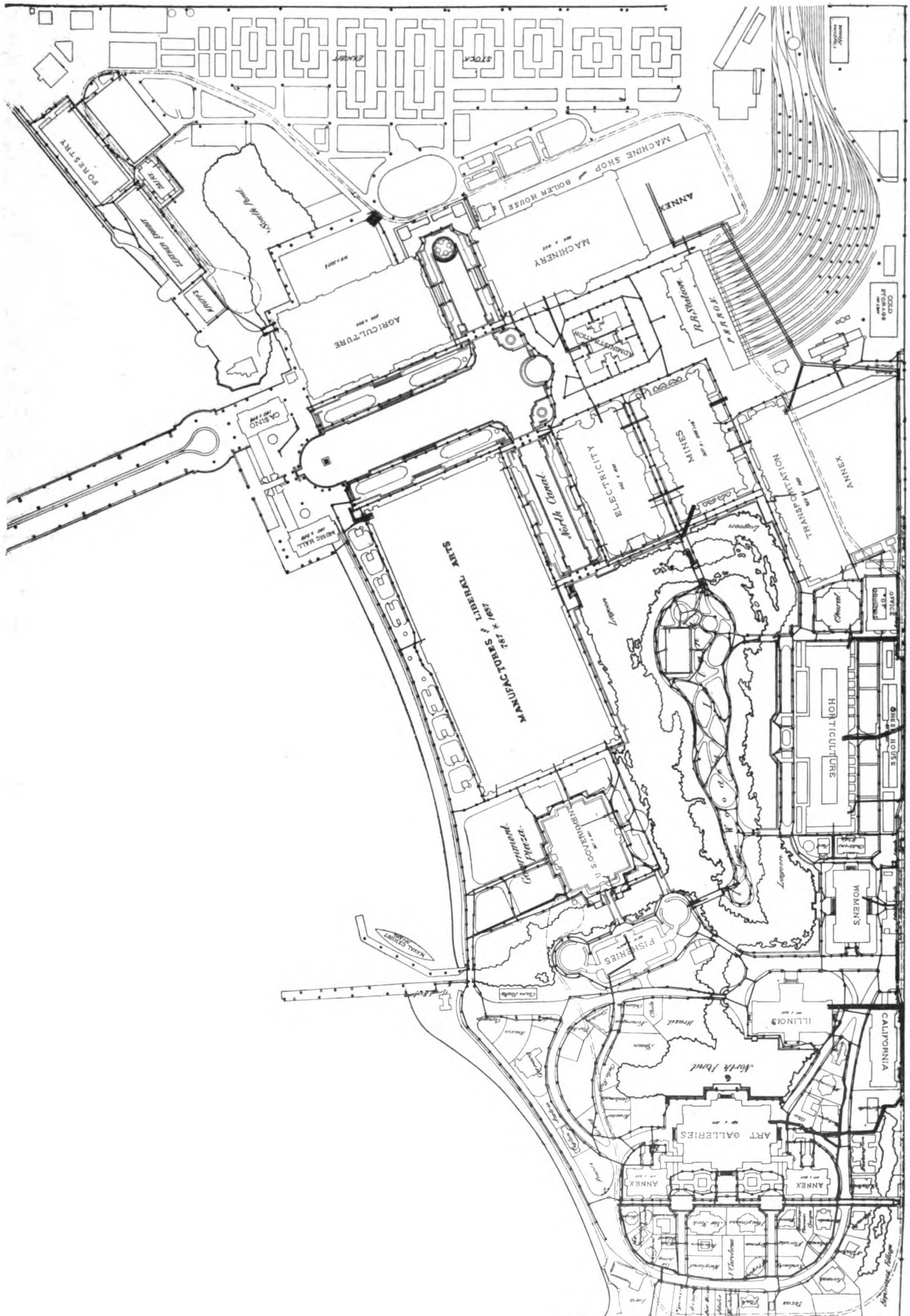
There are two high pressure cylinders 30 inches in diameter, and two low pressure cylinders 60 inches in diameter, all having a stroke of 60 inches and 52 strokes per minute. The plunger is 32 inches diameter and "outside packed." In case this pump should be disabled, the piping is so arranged that it can easily be thrown on to another pump.

The construction of the fountains and electrical equipment of the same was contracted for by the General Electric Company, and Lieut. E. J. Spencer, the special agent in charge for the company is to be congratulated on the thoroughness with which the work has been done. The operating switchboards, indicators and lamps, were designed by Mr. E. R. Knowles, and built under his supervision at the factory of the Schuyler Electric Light Co., New Britain Conn.

An Interesting Electric Road.

There has recently been projected near Pasadena, Cal., an electric railway which involves some interesting features. The road is designed for tourist travel, to enable the visitors to view the scenery of the Sierre Madre. The trolley system is to be used except in one lift of 3,500 feet from Rubio Canon to the submit of Echo Mountain, on which an endless cable will be used.

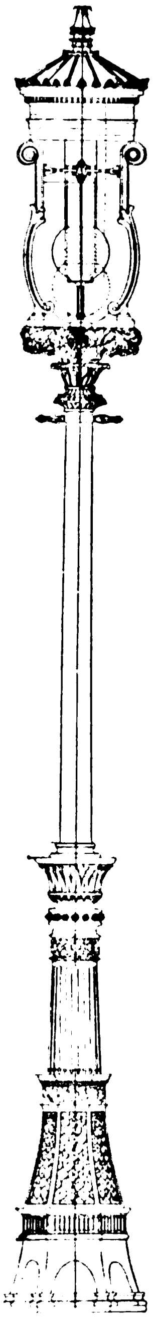
This cable will be run by an electric motor, the current for which as well as for the trolley line is furnished by generators run by water power. Pelton water wheels are used operated by a small stream which has a head of 1,700 feet. This is used in three sections, the second section utilizing the water from the first wheel and the third from that of the second. Accumulators will be used which will be stored when the line is idle for use when a large amount of current is required. These generators will furnish electricity also for the lights which light the grounds and hotels at the summit. Mr. T. S. C. Lowe is the projector and builder of the road and for him the peak at the end of the road is named. Mr. Lowe was a great student of electricity and conducted a great many experiments early in life and some of his apparatus used in connection with his lectures appear to contain many of the principles involved in the incandescent lamp over which there has recently been so much controversy. At the office of the Pasadena Mountain Railway may be seen an interesting relic of those lecturing tours consisting of an ebony stand, above which suspended by wires are two sealed glass globes, within which are little filaments that were made to glow by passing an electric current through them from a battery. He also gave considerable attention to aerial currents and was appointed chief of a balloon corp during the civil war. Lowe's water gas is another of his inventions. He retired to Pasadena a few years ago to enjoy his declining years but his active mind soon saw the possibilities of the little mountain stream for carrying people to the grand scenery among the mountains.


STOCK EXHIBIT
FORESTRY
DAIRY
LEATHER EXHIBIT
South Pond
MACHINE SHOP & BOILER HOUSE
MACHINERY
ANNEX
AGRICULTURE
ADMINISTRATION
R.R. Station
COLD STORAGE
CASINO
MUSIC HALL
MANUFACTURES & LIBERAL ARTS 787 x 1687
North Canal
ELECTRICITY
MINES
TRANSPORTATION
ANNEX
Lagoon
Wooded Island
HORTICULTURE
GREEN HOUSE
Government Plaza
U.S. GOVERNMENT
NAVAL EXHIBIT
FISHERIES
WOMEN'S
ILLINOIS
CALIFORNIA
North Pond
ART GALLERIES
ANNEX
ANNEX

LIGHTING THE GROUNDS OF THE WORLD'S COLUMBIAN EXPOSITION.—ARRANGEMENT OF ARC LIGHTS.

Lighting the Grounds of the World's Columbian Exposition.

One of the most striking features of the World's Fair as seen at night, is the brilliant illumination of the grounds, walks, bridges and all the vast area outside of the buildings themselves. To the electrical engineer or, in fact, any person, connected with or interested in similar work, the location of the arc lamps and the arrangement of the circuits is especially interesting, owing to the irregular spaces and areas, some being long and narrow, others very broad and open, and yet others very crooked and irregular. Precedents were rare indeed and none were available for this case.



Where the territory to be lighted is broad and unobstructed the lighting is sometimes done by bunching a large amount of light at one or more points and at some considerable elevation above the ground. This method was used more frequently in the earlier days especially for parks, and in open country free from trees, but owing to its defects has gradually been abandoned. The question of location and method was carefully considered in all its bearings, and it was finally decided that the placing of smaller units at more frequent intervals and not too high from the ground would give much the best results. Of course there are many localities in the grounds, where it was entirely out of the question to use any bunching of lights at an elevation, but some of the broad plazas might have been treated that way, although the result would have been far from equal to the method finally adopted.

A very neat and ornamental iron lamp post was designed and is manufactured by R. B. Ayers, Masonic Temple, Chicago, which supports the lamp on its top, and brings the center of the globe seventeen feet above the level of the ground. Being placed as nearly as circumstances will permit at distances apart in line of about 75 feet, and about 40 feet from buildings, there is no part of the grounds that is not brilliantly and evenly lighted. In some few cases of very broad plazas, as that between the Administration building and Machinery hall, three lamps have been bunched on one specially designed post, thus combining the bunching and single unit systems in such a manner as to allow of somewhat broader spaces between lamps.

The accompanying map shows the location of the lamp posts and the course of the underground ducts leading to them, the black dots being lamp posts and the heavy lines the circuits. The lamp post itself is supported on a wooden cribwork foundation, built in the earth with the top cap just flush with the level of the ground; fig. 1 is a plan, and fig. 2 an elevation of the same. At the side of each lamp post foundation and spiked securely to its side is the hand hole box in which the joints and connections are made in the main line of wires leading up through the interior of the post to the hanging board in the hood; fig. 3 is a detail of this box.

A special curve of vitrified clay pipe, three inches inside diameter is used to make the turn from the hand hole box up through the foundation to the bottom of the iron post; vitrified pipe three and four inches inside diameter buried two feet in the earth is also used when it is necessary to carry lines under the buildings; all other ducts are pump logs of square outside section, with a circular bore two and one-fourth inches inside diameter and in eight and ten foot lengths.

The circuits being all underground of course, none but first class insulated wire could be used, as it might result disastrously if circuits crossed or grounded during the presence of great crowds of people; in fact, the entire installation has been carried out in the most thorough manner, and as if for permanent instead of temporary use.

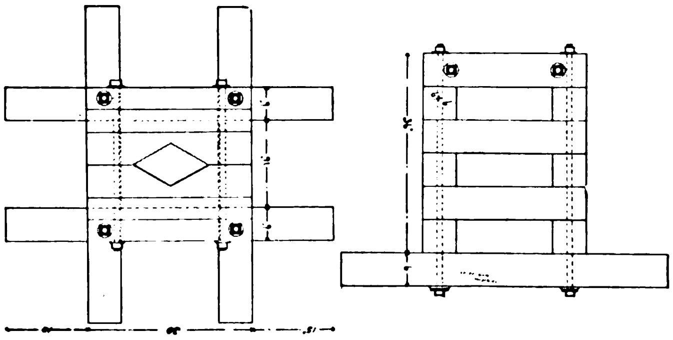


FIG. 1 AND 2.—PLAN AND ELEVATION OF BASE OF LAMP POST.

The contract for all the underground wire for the arc circuits was awarded to the Safety Insulated Wire and Cable Company, of 234 West 29th St., New York City; who were not only to supply the wire but draw it into the conduits, connect it up and then to guarantee its working without trouble of any kind.

In fulfilling this contract they have drawn into the ducts upwards of 87 miles of solid number 6, B. & S. gauge copper wire, insulated with a layer of rubber, five thirty-seconds of an inch in thickness, wound with a layer of strong tape and covered over all with lead, five sixty-fourths of an inch thick.

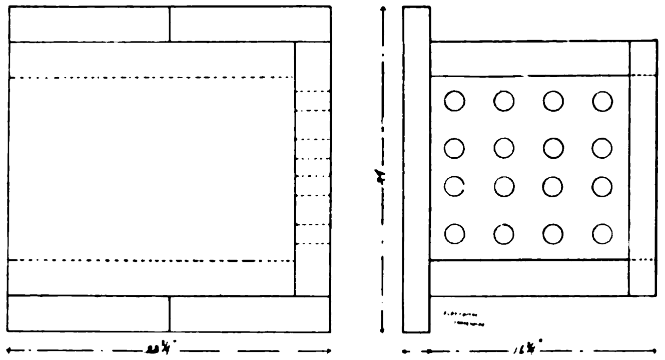


FIG. 3.—DETAIL OF HAND HOLE BOX.

The insulation resistance is tested at the factory to a standard of 1,000 megohms per mile. The joints in the wire are all made by soldering a copper sleeve of proper dimensions over the abutted ends and then wrapping very carefully with pure para rubber, the whole being finished by slipping a lead sleeve over the wrappings of rubber and fastening it to the lead covering by a plumbers wiped joint. The rubber makes a most perfect insulation for the wire, and the lead covering being made practically air tight excepting at the terminals, preserves the rubber from danger or deterioration from gases or mechanical troubles. Rubber insulated wires of a similar make, drawn into the conduits in New York City some five years ago, still hold the original insulation resistance. The lamps used are of the 450 Watt standard, 10 amperes and 45 volts, and have been divided up among the companies as follows: viz., Standard, 350; Excelsior, 100; Western Electric, 100; Fort Wayne, 540; Thomson-Houston, 150; Brush, 400, total, 1,640 arc lamps outside of the buildings and for the illumination of the grounds alone. It would indeed be difficult to find another place where arc lighting has been used so liberally as here.

It would be hard to estimate the amount of good that will be done both the artistic and practical sides of public arc lighting by the exhibition of lamps installed as are these, on ornamental posts and without wires showing in any manner. It has so long been thought by the general public, and more especially by the smaller electric lighting companies that it was practically impossible to place wires underground and out of sight in any safe and substantial manner that the effect of this insulation, which will be seen by the people from all over the world, will do more to show the benefits of proper electrical engineering than any movement yet made in that direction. Great credit is due the electrical engineers, Messrs. Frederick Sargeant, R. H. Pierce, and especially to Mr. George B. Foster, who has had direct charge of the arc lighting, and to his assistant Mr. Peck. Credit is also due Mr. O. Monroe, who has had charge of placing the wires for the Safety Cable Co.

Some Remarks on Trade Marks.

By C. A. Brown.

Why is it that corporations, firms and individuals give so much more attention to patents than to trade marks? If a comparative estimate of the value of patent and of trade mark property in the United States were to be made, it is likely that the amount of property founded on trade marks, or rights analagous to trade marks, would far exceed the amount of property founded on patents. Instances of the value of trade marks will occur to everyone. As an instance: Not very many years ago Smith Bros. started in the confectionery business in Poughkeepsie, New York, in the humblest manner Today the trade mark rights of Smith Bros. cough drops are probably worth a million of dollars.

Patents live for seventeen years at the longest. Trade marks live forever unless clearly abandoned. A majority of the patents which are passed upon by our courts are found invalid. By far the greater number of trade marks which are presented to the courts are found valid. The courts are exceedingly liberal in protecting trade mark property.

Trade marks are protected by common law as well as by statute, and the owner of a trade mark may generally seek relief in either the federal or the state courts. The right to a trade mark does not depend upon statute, and it is protected without registration. Public use, which defeats a patent, establishes a trade mark. A trade mark is good everywhere in the civilized world. To protect a trade mark right in one country it is not necessary to be on the alert to prevent its lapsing in another. Where it is good in one country it is good everywhere, and will be protected by the courts everywhere.

There are many more distinctions in favor of trade marks as compared with patents. The partiality of the law to trade mark property is noteworthy, and is founded, as are all well settled principles of the law, on right reason.

There is no speculation in a trade mark. Property in it does not exist apart from the meritorious foundation of service to the public. It simply indicates the origin of the article to which it is applied. If a person introduces into trade an article of commerce, and by the merits of the article, or by the skill and industry with which it is introduced, a great demand is created, the trade mark which is associated with the article becomes a valuable property right. But a trade mark applied to an article for which there is no demand is valueless. Thus its value is measured by and becomes itself the measure of service done to the public, and the favor which the law manifests toward rights therein is the expression of public justice.

The fact that there is no speculative value in a trade mark, that its value is one which is earned may account for the greater attractiveness of patents to those engaged in the pursuit of wealth. Property in trade marks is more sure, more lasting, and receives better protection from the courts than property in patents. But property in patents when it is valuable generally becomes so speedily, while the value of trade mark property is a matter of growth.

The speculative nature of patent property seems to be one of its chief attractions. A prominent patent expert of wide experience has said that with the best kind of a patent case the complainant runs 55 chances in a hundred of winning, while with the worst kind of a case he will still stand 45 chances in a hundred of winning. When chances are so nearly even the gambling instinct impels every one to try the game. How close the chances are and how much depends upon the habits of mind of the judge is shown in the decisions of Judges Colt and Hallett in the lamp cases recently decided. Judge Gresham recently said about a case which was being presented to him at final hearing: "I have no doubt I could decide this case either way, and find authority for it in Supreme Court decisions."

The juggling of experts and counsel with the language of patents and the resulting uncertainty of courts in their construction of patents introduces the elements of speculation in patent property which gives zest to its control. It is quite rare that the actual device of a patent which turns out to be valuable is manufactured as shown in the patent. Subsequent improvements generally make such devices practical. It was the language of the original Bell telephone patent that was infringed by other telephones, not the device of the patent. By a majority of one the Supreme Court decided in favor of the Bell patent after years of the most expensive and skillful litigation in the history of our patent system.

Of all this element of chance the legal protection of trade mark property is almost entirely free. It is a good sign to see increasing efforts in the direction of building up trade mark property. It breeds the right habit of mind in the community. Our patent system is a benefit to our country; of that there is no doubt, but it is not an unmixed blessing. A trade mark is free from many of the evils which attach to patents.

It has no suspicion of monopoly or restriction of trade. It is the manufacturers' guaranty of the quality of the goods. It gives owners the right to say, not that another shall not sell exactly the same article or a better article or a worse one than that which bears the mark, but that whatever is sold shall not be sold in a way to deceive the public, and make purchasers believe it is the article to which the trade mark was originally applied. Trade marks are beneficent and deserve the favorable protection which they receive from the courts.

Street Railway Franchises.

BY S. T. C.

The question of rapid transit is now being so strongly agitated in all our growing cities that one seldom takes up a paper nowadays without finding in it some allusion to a street railway franchise. While rapid transit is demanded on all sides and by all classes, it must be admitted that the conditions almost sure to be attached are enough to deter any straightforward capitalist from taking it up at anything like a fair risk.

The tendency everywhere is to exact from the corporation applying for such a franchise the very largest amount of cash that can be got, and, almost always in addition to this a large percentage of the receipts. Such amounts are of course taken into the city treasury and applied in some manner on the taxes or indebtedness of the town. In a few cases, the tax on the street railway is in the shape of a park tax, that is, a certain amount is paid to the park commissioners for each passenger carried, for the support or purchase of public parks. When a franchise is purchased by a corporation the amount paid for it is charged off pro rata each year, during the term of the same, thus gradually reducing the cash value to the end of the term. The percentage of receipts is deducted from the income. While ostensibly the profits of the company are reduced by such payments, there are other methods of doing it which have a somewhat fairer distribution of the benefits. As it is unquestionably the fact that by far the larger number of the patrons of a street car line are of a class who pay small if any taxes and who would therefore be little benefitted by the payments of the company to the city, the very parties who are benefited by such payments are also of a class who are not in any particular need of such help.

It has been long assumed that five cents or the handy nickle is the lowest fare that the American public will demand, but action has been recently taken by one road at least to reduce the fare to four cents. At Washington, D. C., six tickets are sold for twenty-five cents which is practically the same thing. If a street railway franchise were to be put up at auction, not to the highest bidder, but to the parties offering to carry passengers for the lowest fare, then the benefits of such sale would accrue directly to those most interested. It may be said that in such case the company would use only the cheapest equipment if they found they were not making large dividends; this reasoning might apply on a restricted franchise where there was considerable risk, but with a franchise unrestricted as to term and in other essential features, such risk would be entirely removed and capitalists would willingly invest at a much lower rate of interest. Another way would be to sell the franchise to the parties bidding the lowest rate of return for the investment, with proper provision for inspection of accounts. The whole subject deserves much more careful consideration than is usually given it and people should be switched off the one idea of sale to the highest cash bidder. As the corporation is obliged to stand any deduction agreed to, it makes no particular difference how it is made; therefore, it would seem only fair to let the people who ride—and they are the ones directly interested—have the benefit of any such deduction and this can only reach them through lower fares.

Electrical Industries

ELECTRICITY BUILDING, WORLD'S FAIR.

Electric Lighting on the South Side Elevated Road.

A decidedly new feature in railroad equipment has been introduced on the South Side Elevated Railroad, Chicago, by the installation of an electric lighting plant for lighting the stations and platforms along its line.

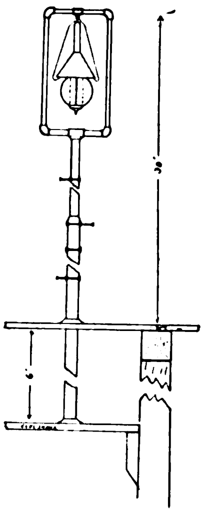
This road was first opened to the public last June, when the road was completed as far south as 39th street, and from the first has received a very liberal patronage. The road now reaches the World's Fair grounds, where it has excellent terminal facilities. It is about eight miles long, and has 21 stations. Gas pipes and fixtures were put in when the stations were built, and up to the present time gas has been used for lighting. A great deal of trouble was experienced with the gas during the cold weather of last winter which undoubtedly is part at least responsible for the change to electric lights.

A commodious and neatly arranged power house has been erected on the right of way at 61st street. The structure is of brick, one story, with high ceilings, well lighted and easily ventilated. The boiler room is separated from the dynamo and engine room by a brick wall. Two Heine safety boilers are now in place, and the boiler room has been planned so as to permit the erection of other boilers at the side of these whenever it is desired to increase the plant.

In the engine and dynamo room are two Ball & Wood tandem compound 100-horse power engines belted to 2,000 volt alternating Siemens & Halske dynamos. All the electrical apparatus about the station is of Siemens & Halske manufacture, including the switches, ammeters, voltmeters, rheostats, etc. The management has expended a large amount of money in providing ample fire protection. Two large reservoirs have been constructed, connected with the city mains, and within the station is a Worthington fire pump capable of throwing a large stream.

The current is conveyed by Standard Underground Company's duplex cables suspended by hangers from number four galvanized iron wire which is fastened to the girders that support the track. These cables are run to the transformers placed in the stations by which the current is reduced from 2,000 volts to 75 volts. The transformers were manufactured by the Stanley Electric Manufacturing Co.

The stations are lighted by both incandescent and incandescent arc lamps, the latter being placed two in series, one of which is placed before the entrance to the station and the other in the center of the waiting room. The resistance coils used are very simple in construction, and are also manufactured by the Siemens & Halske company. The incandescent lamps are distributed about the interior of the station and station platforms, and are controlled by switches in the station. This plant also lights the terminal station at the Exposition grounds and the yards between 61st and 62nd streets on the line of the road. The yards, which are on a level with the elevated tracks, are lighted by incandescent arc lamps supported on posts of a very ingenious and serviceable design. They are made entirely of wrought iron pipe, as shown in the accompanying cut, which also allows the wires to be brought up from below and concealed in the pipe, and only exposed where brought out at the top to connect with the lamp.



DETAIL OF LAMP POST.

The steps are five eighths inch iron bolts that pass through the pipe and are fastened by the nut. The lower part of the post is of four and a half inch iron pipe which rests on a piece of timber supported on the posts that support the track. An iron collar screwed to the plank floor holds the post in an upright position. The upper part of the post is three and one-half inch wrought iron pipe, while the frame about the lamp is of one and three-quarter inch iron pipe. The cut outs, switches and resistance coils are placed in a weatherproof box below the tracks and are reached only by a ladder. The whole system is so arranged that the wires are all below the track, and none of them are where they are likely to be interfered with.

Report of the Massachusetts Gas and Electric Light Commissioners for 1892.

We are in receipt of the eighth annual report of the board of Gas and Electric Light Commissioners of Massachusetts. It is as usual very complete and furnishes good data for the consideration of both gas and electric companies. We notice a great discrepancy between accidents and deaths due to the two methods of lighting: gas is credited with four or more accidents and nineteen deaths while only three accidents and four deaths are attributed to electricity.

The following tables show a considerable increase in the business for the year 1892 over that of 1891:

	Year Ending June 30.	
	1891.	1892.
Receipts.		
For light and power,	$2,432,869.15	$2,947,199 64
From other sources,	7,481.50	23,438.30
	$2,440,350.65	$2,970,637.94
Expenses.		
For manufacture,	$1,014,242.88	$1,156,320.69
distribution,	356,332.38	386,084.45
office expenses and management,	159,230.90	194,999.25
taxes,	82,743.77	107,291.15
miscellaneous,	122,656.20	170,707.32
	$1,735,206.13	$2,015,402.86
Leaving a balance of	705,144.52	$955,235.08
Of this profit, the gas companies made in their electrical departments,	143,240.78	189,225.74
Leaving for the electric light companies. To which should be added the income from rents, jobbing, etc., amounting to	$561,903.74 45,022.10	$766,009.34 195,280.73
Making a total of	$606,925.84	$961,290.07
Against which the following charges were made:—		
Interest,	$144,678.87	$195,094.15
Dividends,	262,968.00	323,581.00
Depreciation,	41,225.21	210,168.79
Sundry items,	7,671.57	32,227.49
	$456,543.65	$761,071.43
Leaving a surplus to be carried forward of	$150,382.19	$200,218.64
Assets.		
Construction accounts, including patent rights and franchises,	$9,031,520.49	$11,097,808.20
Cash on hand,	262,284.10	419,639.53
Due for light and power,	178.034 22	238,708.79
Other accounts due,	67,475.82	68,026.85
Materials, etc.,	240,933.02	460,153.63
Notes receivable,	84,269.09	69,229.09
Investments,	67,370.94	85,291.10
	$9,931,887.66	$12,438,857.19
Liabilities.		
Capital,	$5,866,300.00	$6,539,700.00
Bonds,	1,923,125.00	2,548,050 00
Notes payable,	1,243,349.96	1,767,907.27
Unpaid bills,	374,818.77	557,947.76
Unpaid dividends,	438.07	2,462.48
Interest due and unpaid,	11,374.50	29,991.06
Other items,	37,654.81	345,831.67
	$9,457,061.11	$11,791,890.24
Reserve and depreciation funds,	80,249.97	132,825.32
	$9,537,311.08	$11,924,715.56
Surplus,	394,576.58	514,141.63
	$9,931,887.66	$12,438,857.19
Of these companies—		
*39 show an aggregate surplus of	$426,759.95	578,266.71
†17 show an aggregate deficit of	32,183.37	64,125.08
Leaving total net surplus, at shown above,	$394,576.58	$514,141.63
Which added to reserves carried as liabilities,	80,249.97	132,825.32
Would show an actual surplus of	$474,826.55	$646,966.95
Equivalent to per cent on capital about	9	$9\frac{8}{10}$

*Forty in 1891. †Twelve in 1891.

The increase in total assets of the electric lighting companies has been 25.2 per cent while the increase in liabilities is but 20 per cent, and the increase in surplus account of 30 per cent added to the reserves, carried as a liability makes a total net surplus of $646,966.95 or an increase of 36.3 per cent over that of the previous year. A like favorable result is shown in the operation accounts; for instance the receipts have increased 21.7 per cent while the operating expenses have increased only 16 per cent. It is common to rate the standing of a company on the percentage that operating expenses bear to the earnings; in 1891 this percentage was 71 and in 1892 67.5, showing a very commendable decrease in the cost of operation. The increase in the net earnings of 58.5 per cent over the previous year is very large and is indicative of very much better management on the part of the companies.

Dividends on capital stock have increased from 4.48 per cent in 1891 to 4.95 per cent in 1892, and the amount charged off for depreciation from .456 per cent on the value of the construction in 1891 to 1.9 per cent in 1892. We are very glad to see this as it indicates a growing conservatism of management which, with the increase of 33 per cent in net surplus is commendable. It is a pity that it is not possible to extend these accounts a trifle farther and show an out-put statement, as this divided into the total operating expense would give unit costs of the work. The labor required is but a mere trifle after it is well started and the results to the companies themselves in tracing excessive costs are more than commensurate with the extra trouble.

Appendices E. and F. give instructions on the forms of returns for towns owning their plants; with the exception of a few appropriation accounts and others relating solely to city affairs, the form is similar to the one used for private companies. One suggestion in regard to the expense accounts as here listed; carbons, oil and waste, globes and water, in total, amount to so small a sum, seldom over 10 per cent of the total expense, that they could very conveniently be lumped into one account called supplies. However, it is merely a matter of bookkeeping, and as it was started with all those accounts itemized we suppose it will stay so. The report deserves very careful perusal.

The Strife Between the General and Westinghouse Companies.

Considerable surprise was experienced the middle of the month by the announcement that the Westinghouse Electric & Manufacturing Company had caused the arrest of several persons for stealing blue prints at the instigation of the General Electric Company and had brought suit against the latter company in the Supreme Judicial Court at Salem, Mass. On the part of the Westinghouse company it was claimed that it had missed blue prints of its latest styles and designs of machines from its draughting department and that as far back as last July an arrangement was made under the direction of Mr. Coffin, the president of the General company, with the assistance of Mr. W. J. Clarke, by which a certain young man entered the employ of the Westinghouse company as a draughtsman at Pittsburg for the purpose of getting information for the benefit of the General company and for which he received a liberal fund by means of which he was enabled to secure the desired information. In this way it was placed in a position where it could use the designs of new machines and information almost as promptly as the Westinghouse company itself.

On the part of the General company, its officials deny all knowledge of the thefts and say while they may possess some technical matter, originating with the Westinghouse company it had come to them through the ordinary channels by which it would reach their customers or any one else; or through the changes of employes, many of whom had worked for a number of different companies and were greedy collectors of blue prints, etc. By the same means the Westinghouse company had undoubtedly in its possession a large number of drawings, prints, etc. of the General Electric Company's machines.

George Westinghouse, Jr., made the statement that: "the action which had been taken was an absolute necessity, in view of the great injury being worked to the company by the conspiracy. But the matter is now in the hands of the commonwealth, and must rest there, so that there is nothing which the company can properly say."

The Van Depoele Trolley Patents.

Suit for infringement of patents has been brought by the Thomson-Houston Electric Company against the Winchester Avenue and West Haven Electric railway in New Haven; the Westinghouse Electric and Manufacturing Company of Pittburgh being made party defendant in the same.

Suit is brought on the alleged infringement of two patents on trolleys, applications for which were filed in the Patent Office during the years 1887 and 1888; patents being issued April 11, 1893 to Chas. J. Van Depoele and assigned by his estate to the Thomson-Houston Electric Company. Injunction is asked, restraining the defendants from using their present trolleys and the suit is brought as a test case but it will be some time before a hearing is reached. As these patents, covering most fully every form of under running trolley made, were issued so lately, the Thomson-Houston Company (which of course means the General Electric Company) are certainly very prompt in testing their validity. It would seem from a casual examination that they had assumed a rather large contract. There seem to be several instances in which very similar types of trolley were in use, the most notable being the shuttle device used at Lichtanburg in 1880 by Siemens and Halske who had also used it previously. It is said to have been used at the Paris Exposition of 1881 and in numerous other instances. The overhead trolley line switch is also included in these patents and seems to be pretty thoroughly covered, although the device is so simple that it may be hard to sustain a patent.

It is quite evident that the company does not intend to run any further risk of losing its rights by outlawing of claims.

Obituary.

At his residence at Queens Gate, London, died on the seventh inst., Sir James Anderson, well known as the commander of the Great Eastern during her Atlantic cable expedition, and for the part he took in this enterprise he received the honor of knighthood. He was born at Dumfries in 1824, at the age of 16 joined the merchant marine and has been connected with several enterprises ever since. At the time of his death he was connected with a number of English cable companies.

Cost of Street Lighting by Municipal Plants.

Mr. Lewis Kingman, city engineer, has placed before the public during the last month a very interesting and complete table of the cost of lighting the city of Topeka, Kansas by arc electric lights. The power plant consists of three boilers and three engines worked to 235-horse power, belted direct to six 30-light Indianapolis Jenney arc dynamos. Although he does not say whether the engines are simple or compound, or whether condensing or not, we judge them to be simple and non-condensing by the consumption of 5.7 pounds of coal per horse power.

A careful test made of a number of the lamps in different parts of the city gives an average of 19 amperes and 23.15 volts per lamp or 239.85 watts.

The cost of the plant is stated as follows: Lot and building, $8,559.33; plant, polls and wire, $46,888.65; total, $55,447.98 or $301 per lamp installed. In the table No. 1, are given the number of nights run each month, hours run per month and cost of coal, labor, etc. The last column showing the cost of lamp per 100 hours places the cost in shape to be of great value for comparison. More often the lamp hour is taken as the unit but it is easily raised to the 100-hour unit and may show to better advantage. The average as shown is $3.86 per 100 lamp hours and agrees closely with figures on other plants of a similar nature. The expense for coal as shown is excessive, probably from the style of engines and to the loss on the lines due to the low tension currents, which in this case will be 27.8-horse power as compared with nine-horse power if high tension lamps were used. The saving in the line loss would amount for the period given to $1119.00. The cost of labor as indicated by the percentage of total cost is also high. In table 2, is shown the cost during each year of operating the plant with the percentage of each item of the whole cost of

TABLE 1.—COST OF LIGHTING, BY ARC LIGHTS, CITY OF TOPEKA, KANSAS.

Number.	Year and Month.	Nights Run During Month.	Hours Run During Month.	Average Number of Hours Run.	Coal.		Cost of Coal per Horse Power.		Cost of Carbons.	Cost of Globes.	Cost of Oil and Waste.	Cost of Repairs.	Expenses Insurance, Telephone.	Pay Roll of Superintendence and Labor.	Interest on Cost of Plant at 6 per cent.	Entire Expense per Month.	Cost per Lamp per Month.	Cost per Lamp per 100 Hours.
					Tons.	Cost.	Per Night.	Per Hour.										
							Cents.	Cents.										
1...	November, 1889	28	340.03	12.14	236.00	$566 40	8.60	0.71	$110 07	$13 50	$22 15	$12 15	$32 88	$483 32	$277 24	$1,517 71	$8 25	$2 43
2...	December, 1889	29	373.47	12.88	261.00	626 40	9 19	0.71	142 40	8 25	27 27	133 74	29 58	531 00	277 24	1,775 88	9 65	2 59
3...	January, 1890	29	357.40	12.32	222.00	532 80	7.82	0.63	142 40	18 75	26 93	167 97	30 68	497 50	277 24	1,694 27	9 21	2 58
4...	February, 1890	26	298.73	11.49	216.90	520 56	8.52	0.74	123 00	9 00	23 31	154 89	28 58	496 25	277 24	1,632 83	8 88	2 97
5...	March, 1890	27	274.83	10.18	194.85	459 40	7.24	0.71	123 00	13 00	23 45	180 13	29 58	498 00	277 24	1,603 80	8 71	3 17
6...	April, 1890	30	265.42	8.84	190.00	456 00	6.47	0 73	109 67	13 38	25 49	90 21	32 59	509 75	277 24	1,514 13	8 23	3 11
7...	May, 1890	28	171.92	6.14	156.00	374 40	5.69	0.93	70 27	8 17	24 06	27 47	29 38	508 33	277 24	1,319 32	7 17	4 17
8...	June, 1890	27	132.91	4.92	76.00	182 40	2.87	0.58	50 90	3 50	32 25	94 07	31 83	516 50	277 24	1,188 69	6 46	4 86
9...	July, 1890	28	146.34	5.22	110.40	283 86	4.31	0.82	60 00	3 50	19 60	100 78	37 93	523 38	277 24	1 296 29	7 04	4 82
10...	August, 1890	28	182.50	6.51	144.00	345 60	5.25	0.80	70 27	2 50	21 36	57 90	32 48	515 75	277 24	1,323 10	7 19	3 94
11...	September, 1890	27	211.69	7.87	154.30	403 66	6.36	0.81	81 98	5 00	25 32	48 95	32 73	516 50	277 24	1,391 38	7 56	3 56
12...	October, 1890	25	204.04	8.16	110.00	361 11	6.15	0.75	79 56	5 00	22 10	64 72	34 48	467 75	277 24	1,311 96	7 13	3 50
13...	November, 1890	24	206.00	8.58	126.35	385 37	6.83	0.80	74 02	9 00	22 00	79 78	49 03	523 41	277 24	1,419 85	7 72	3 75
14...	December, 1890	25	198.25	7.93	123.40	373 70	6.36	0.80	83 65	3 50	15 61	86 11	31 78	525 00	277 24	1,396 59	7 59	3 83
15...	January, 1891	24	189.17	7.88	122.65	374 08	6.63	0.84	71 70	6 00	19 89	100 29	38 06	530 25	277 24	1,417 53	7 70	4 07
16...	February, 1891	21	157.50	7.50	83.75	249 18	5.05	0.67	65 72	3 50	17 30	195 94	33 26	529 50	277 24	1,371 64	7 46	4 75
17...	March, 1891	23	158.50	6.89	102.80	302 73	5.60	0.81	71 70	2 50	13 63	102 11	36 73	528 98	277 24	1,336 82	7 26	4 60
18...	April, 1891	21	141.83	6.75	109.00	317 42	6.43	0.95	64 80	3 00	13 98	41 36	37 36	525 75	277 24	1,280 90	6 96	4 90
19...	May, 1891	23	127.05	5.52	101.00	294 99	5.46	0.99	60 00	3 00	10 30	56 29	45 56	525 00	277 24	1,272 38	6 92	5 45
20...	June, 1891	23	118.08	5.13	86.80	264 74	4.89	0.95	55 20	4 00	9 92	56 04	47 46	525 00	277 24	1,229 60	6 68	5 66
21...	July, 1891	27	138.75	5.14	75.13	230 73	3.63	0.71	55 80	4 00	10 36	39 80	40 91	525 00	277 24	1,183 84	6 43	4 63
22...	August, 1891	28	172.05	6.14	90.10	274 80	4.17	0.68	72 00	2 00	14 62	67 57	33 31	525 00	277 24	1,266 54	6 88	4 00
23...	September, 1891	30	251.05	8.37	108.95	331 55	4.70	0.56	72 00	3 00	20 70	171 95	35 61	525 00	277 24	1,437 05	7 81	3 11
24...	October, 1891	16	140.75	8.79	106.00	323 30	8.60	0.98	60 00	2 00	10 85	730 69	35 16	510 00	277 24	1,949 94	10 59	7 51
25...	November, 1891	28	244.41	8.73	136.45	395 70	6.01	0.69	96 00	6 00	19 50	110 59	35 86	533 10	277 24	1,473 99	8 03	3 29
26...	December, 1891	27	227.50	8.43	143.20	415 28	6.54	0.77	90 00	4 00	12 40	74 29	33 01	525 97	277 24	1,432 19	7 78	3 43
27...	January, 1892	25	214 33	8.57	142.40	412 96	7.08	0.82	84 00	4 00	12 62	147 75	34 06	523 75	277 24	1,496 38	8 13	3 80
28...	February, 1892	23	204.00	8.87	160.40	465 16	8.60	0.97	79 20	4 50	12 47	27 87	34 71	525 00	277 24	1,426 15	7 75	3 80
29...	March, 1892	24	190.35	7.93	134.60	390 34	6.92	0.87	72 00	3 00	12 33	88 87	33 06	525 00	277 24	1,401 84	7 62	4 00
30...	April, 1892	22	148.05	6.73	103.15	299 14	5.78	0.86	66 00	10 00	7 44	260 15	34 71	527 25	277 24	1,481 93	8 05	5 44
31...	May, 1892	27	171.08	6.33	107.10	310 59	5.05	0.79	66 00	29 25	16 44	54 97	33 86	525 00	277 24	1,313 35	7 13	4 17
32...	June, 1892	22	117.50	5.34	78.50	227 00	4.39	0.82	48 00	6 00	8 65	674 93	39 56	525 00	277 24	1,806 38	9 81	8 35
33...	July, 1892	25	126.91	5.07	78.75	228 38	3.88	0.76	48 00	2 00	7 83	46 90	30 96	525 00	277 24	1,166 31	6 34	4 99
34...	August, 1892	26	156.83	6.03	97.50	272 85	4.46	0.73	60 00	6 00	11 94	82 92	35 66	528 22	277 24	1,274 83	6 92	4 41
35...	September, 1892	25	192.00	7.68	124.00	355 54	6.06	0.79	60 00	6 00	11 04	104 25	35 11	531 64	277 24	1,374 82	7 47	3 89
36...	October, 1892	27	202.75	7.51	134.87	391 12	6.16	0.84	84 00	6 00	12 00	221 71	34 86	536 00	277 24	1,562 93	8 49	4 18
37...	November, 1892	26	231.33	8.90	178.25	499 10	8.19	0 92	96 00	4 00	13 50	33 48	33 91	526 00	277 24	1,483 23	8 06	3 48
38...	December, 1892	26	237.50	9.13	152.25	426 30	6.97	0.76	72 00	2 00	12 09	57 99	33 66	525 00	277 24	1,406 28	7 64	3 22
	Totals	970	7,682.80	7.86	5,078.60	$13,924 64	Av. 6.11	Av. 0.777	$2,981 31	$235 80	$642 70	$4,847 57	$1,329 96	$19,743 86	$10,535 12	$54,240 95	Av. $7 75	Av. $3 86
	Per cent. of total expense					25.67			5.51	0.43	1.18	8.93	2.45	36.40.	19.43	100.00		

The best lump coal has been used, at an average cost of $2.75 per ton.

The system of distribution includes 33½ miles of wire placed on 30-foot poles of which there are 943, except at the intersection of streets where the lamps are hung, 40-foot poles are used. The pole line is nearly 25 miles long. The lamps in the business portion of the city are placed at every street intersection and in the residence portion at every alternate intersection. The greater portion of the lamps are 1,100 feet apart one way and 800 feet the other. There are 184 lamps rated at 2,000-candle power.

TABLE 2.—COMPARATIVE COST OF LIGHTING FOR DIFFERENT YEARS.

ITEMS.	1890.			1891.			1892.		
	COST.	PERCENTAGE OF WHOLE COST EXCEPT INTEREST.	PERCENTAGE OF COST INCLUDING INTEREST	COST.	PERCENTAGE OF WHOLE COST EXCEPT INTEREST.	PERCENTAGE OF COST INCLUDING INTEREST.	COST.	PERCENTAGE OF WHOLE COST EXCEPT INTEREST.	PERCENTAGE OF COST INCLUDING INTEREST.
Fuel	$4,678.86	34.	27.	$3,774.50	28.	22.6	$4,278.48	30.	25.
Carbons	1,058.72	7.7	5.9	834.92	6.	5.	835.20	6.	4.8
Globes	94.30	.7	.5	43.00	.3	.25	82.75	.5	.4
Oil, Waste, etc	281.38	2.	1.6	173.65	1.3	1.	138.35	1.	.8
Repairs	1,152.98	8.	6.7	1,746.90	13.	10.4	414.12	3.	2.4
Expenses, Insurance, Telephone, etc	401.07	3.	2.3	452.30	3.4	2.7	1,801.89	13.	8.4
Superintendence and Labor	6,098 12	44.6	35.8	6,308.55	47.3	37.	6,322.86	46.	36.
Total Cost, without Interest, of Operating System	13,765.43	100.		13,333.83	100.		13,873.65	100.	
Interest	3,328.86		19.5	3,328.86			3,328.86		
Total Cost of Operating System	$17,084 29		100.	$16,662.69		100.	$17,200.51		100.
Average Cost of 100 Lamp Hours		$2 82	$3.55		$3.43	$4.38		$3.44	$4.27
Average Cost of Lamp per Month		6.07	7.74		6.04	7.54		6.28	7.75
Average Cost of Lamp per Year		74 81	92 84		72.46	90.55		75.40	93.00

operating the plant. This plant has been in operation for several years and many of the objections to the lighting of cities by municipal plants are apparent. In the matter of cost there is no doubt that one of the local companies would furnish the same amount of lighting at a cost of from 20 to 30 per cent less than the present cost.

The cost of running the plant is also larger than it would otherwise be on account of the antiquated machinery the city operates, and the expense of labor, which is nearly always high in connection with public work. The city will soon be to considerable expense to renew and repair the machinery in the plant which it is said was never satisfactory. The lamps are too far apart for suitably lighting the city even if there are no trees along the streets. With modern machines and only the necessary number of men required to run and keep in repair the system, a more efficient and greatly increased lighting system could be maintained with no increase of expense; still the plant compares favorably with others owned and operated similarly.

Report of the General Electric Company.

Owing to lack of space we were obliged to omit from our last issue the report of the General Electric Company. Below we give a condensed and somewhat re-arranged balance sheet.

The first four items of the assets are doubtless correct but a careful examination of the last two, viz: stocks and bonds of other companies, and patents would seem to indicate a wish to overvalue the patents at the expense of the stocks. This may or may not be the case, depending on the side from which it is examined. In light of the recent patent litigation, it at least appears plausible. Before the consolidation of the two large companies, it was the habit of each to put but a nominal value on the patents, perhaps from doubt of the results of the then existing litigation and it certainly seems poor policy at the present time to raise the value to the extent shown by this report, as it casts considerable doubt on the value of the surplus. Although the company doubtless know the real value of the securities they take, and ordinarily would place their full value on their balance sheets, if placed low it offers a good chance to show a profit in the future. It may be argued that the surplus could be raised to any amount by placing a higher value on the stocks and bonds; granted, but there is such a thing as overdoing it. We place more confidence in the value of the stocks and bonds held by the companies than is commonly the case, as it would be good business judgment to take only such as were considered good, and in spite of all that has been said on the subject, it is more than probable that only such bonds and stocks have been taken as were so considered. The undeniable fact that the great majority of the stocks and bonds so taken are either sold at a premium over their cost to the company or held for dividends should certainly be considered of more account. Take for instance the securities of the large local Edison Companies, to be sure but a small part of the total, but there are many others on a par with them that are not enumerated. A new view of the real value of the assets can be made by wiping out the surplus, thus leaving the net liabilities of $53,317,597.24; then, to balance this, reduce the value of the patents to the nominal amount of $1,000,000.00 and raise the value of the stocks and bonds to make up the balance. A discount of five and one-half millions of dollars on the stocks, bonds and franchises certainly ought to be enough if they have been selected with ordinary business judgment, and the patents and franchises surely ought to be worth a million dollars. if of any value whatever. In all organizations of this nature it is necessary for the accounting to place a more or less arbitrary value on something in order to show value for stocks or bonds issued. In this case it seems the value was placed rather heavily on the patents and it is a question if it would not have been better policy to value the stocks and bonds assets higher and the patents lower.

Condensed Balance Sheet of the General Electric Company, Eight Months Ending January 31st, 1893.

ASSETS.		
Plant	$4,199,762.62	
Real Estate	298,726.74	
Inventories	9,776,637.42	
Cash, bills and accounts receivable	17,407,184.16	
Stocks and bonds of other Co's. par $26,294,660.00	14,500,976.87	
Patents and franchises	8,159,264.02	
		$54,342,551.83
LIABILITIES.		
Capital stock and bonds	$44,663,800.00	
Debts	8,653,797.24	
Surplus	1,024,954.59	
		$54,342,551.83

Receiver for the National Electric.

The following statement has been received regarding the National Electric Manufacturing Company:

"The event causes a sensation so far as the public is concerned, but the matter has been under consideration for some time. An action had been brought by Jas. T. Barber, et al, against the National Electric Manufacturing Company, H. H. Hayden being the attorney for the plaintiff, the complaint in which sets forth that the company was embarrassed by very pressing claims on the part of creditors which it was unable to pay; that the large plant and valuable business of the company could best be preserved in their entirity for the benefit of all concerned, by the appoint of a Receiver, etc. Mr. Hayden requested the appointment of Ralph E. Rust, as receiver; bond being offered in the sum of $50,000.00 with William A. Rust, John S. Owen, Jas. T. Barber and Fitch Gilbert as sureties. The same being properly filed Judge Bailey made an order appointing Mr. Rust receiver.

Although the company by reason of the general financial stringency has been considerably embarassed the conditions are such that under the Receiver the business can and will be carried on without any interruption whatever. There will be no stoppage and a reorganization will probably be affected within a very few days. The company's plant is worth $300,000.00; there is a large amount of valuable manufacturing products on hand, and there are also large outstanding orders. The assets foot up between $500,000.00 and $600,000.00; the liabilities are about $300,000.00.

The placing of the plant and affairs of the company in the hands of a Receiver is regarded as the very best possible solution of the difficulties which have been encountered. It practically saves the business and the preservation in this manner of this important industry is considered a fortunate outcome."

Electrical Industries.

Entered at Chicago Postoffice as second-class mail matter.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

In this issue will be found a short but interesting article on the costs of operating the municipal electric lighting plant at Topeka, Kas. Mr. Kingman deserves great credit for the care and perseverance he has shown in keeping and arranging the data of this plant. The value of such information cannot be too highly estimated for it enables the management of a central station to know exactly what each kind of expense amounts to, for what it is paying too much and where it can best reduce expenses. It is also valuable for comparison with other plants. Any similar statistics or information sent us by our readers will be gladly received.

Several reports have lately reached us that some of the makers of medical appliances who also manufacture so called electric belts are using the privileges given them as exhibitors at the World's Fair to advertise and sell their belts and other appliances. We hope these reports are not true but if they are we are confident the officials will see to it that the places which know them now will know them no more forever, for as we understand it "fakers" are not to be allowed to trade under the name of electricity on the fair grounds.

Attention is called in this number to the introduction of a new feature, a column of financial affairs. While the first issue may not include all that may be found necessary, the principal securities that are publicly quoted are mentioned and the list will be gradually increased as opportunity offers and the business requires. Incorporated in the text will be found quotations from some of the most prominent and reliable financial journals, and the stock quotations will be obtained from the most reliable sources.

The report of the General Electric Company found elsewhere in these columns has been a common theme of discussion among the electrical and financial fraternity ever since its publication and since the issue of the report of the Westinghouse Electric and Manufacturing Company early the past month both have met with considerable criticism. While it is perhaps not expedient to lay the details of the business before the general public, when the affairs are in as good condition as both these are said to be it certainly would be of great interest and value to investors to at least know the gross earnings and gross expense with a little detail of each. The General Electric Company has placed a high value on its patents, contrary to the policy of the old companies who placed a rather nominal value on them. The Westinghouse company has also rated its patents very high in proportion to the total assets, being 30 per cent of that amount while the General company values its at 15 per cent. Both companies have also placed a questionably high value on the stock and bonds of local and other companies amounting respectively to 26.7 per cent of the total assets in the one and to 31.6 per cent in the other. The fact that the stocks of both these companies were very active in the recent flurry of the industrial stocks and that the prices went down rapidly would seem to show that the speculating public are somewhat skeptical as to the real values of the assets quoted. General Electric stock is lower than ever before in the history of either the Edison or Thomson-Houston companies. While the electrical business requires altogether different methods from other manufacturing business, and its financiering likewise; its financial statements will need to conform somewhat to the common form or the public will not have the proper amount of confidence in them.

TRADE MARKS.

The paper in another column by Mr. C. A. Brown on "Some Remarks on Trade Marks" will be read with interest and profit. Of the comparative value of patents and trade marks there can be little question that the evidence in the several cases cited by the writer is clearly in favor of the latter for while patents may live 17 years at the longest trade marks live forever unless abandoned. The trade mark is good in every country and is protected by the courts everywhere. It is evident that many important cases of patent litigation in the electrical field would have been avoided had it been a case of trade mark instead. According to a prominent expert which he quotes it is estimated that in the best kind of patent cases the complainant runs 55 chances in a hundred of winning while in the worst kind of a case he will stand 45 chances in a hundred of winning. When chances are so nearly even the gambling instinct as he says compels one to try the game. Our patent system is a benefit to the country but after all it is not an unmixed blessing. Trade marks are benificent and deserve the favorable protection which they receive from the courts and it is singular that more attention has not heretofore been paid to the securing of them instead of patents.

RATES AT THE WORLD'S FAIR.

Attention has recently been called by a number of our correspondents to the fact that an impression is abroad in their vicinity that exhorbitant rates for accomodations at the World's Fair are prevailing; in fact, that every visitor is sure to be robbed, as it were. Just where such a feeling comes from is hard to explain. That it does exist we regret exceedingly, and wish right here to say, if any such erroneous opinion is held by any of our readers that we desire to correct it at once, for the Fair is not a swindling scheme, nor is it run by an army of extortionists and robbers. It is true that human nature in Chicago is much the same as elsewhere, and no doubt there are those who see an opportunity to make money from visitors, and while it must be admitted that there has been a tendency on the part of some hotels and boarding houses in the vicinity of the Exposition grounds to raise prices abnormally, the lesson of last month has been a severe one, and as the law of supply and demand regulates these things, reasonable accommodations can be had without the slightest difficulty. An almost unlimited number of temporary hotels and boarding houses has been erected to take care of the multitudes, and as it stands to-day there is evidently an over production of them. On the grounds the restaurant and café prices are regulated, so that they are practically the same as down town prices, although the cost of production is greater, the cost of labor and material being considerably more than in ordinary years. Throughout the city there are any number of hotels and boarding houses, very few of which have raised rates more than enough to cover the actual increased cost. Rooms can be had at less than regular New York prices, and any number of restaurants afford excellent meals at reasonable prices. It must be more borne in mind that this Fair is the greatest undertaking of the kind that has ever been attempted in the history of civilization, and has brought together all classes and kinds of people. Already enormous crowds have visited the Exposition, and within a few weeks greater crowds will home. We sincerely hope that none of our friends will stay away, and thus miss the opportunity of a life time to see not only the products of practically every country in the world, but also the great electrical exhibit which forms beyond question one of the most attractive features of the whole display.

ELECTRICITY ON CANALS.

Many items on this subject have of late appeared in both the daily and technical press. It seems to be assumed that all one has to do is to put up a trolly wire, put on board the boat a screw and motor and go ahead.

If the writers of these articles would take the trouble to investigate the various attempts that have been made in the past to propel canal boats by steam the task would not appear so easy. Many efforts have been made to increase the speed of canal boats in the past by the use of steam propellers and paddle wheels but without success. The wash of the water in every case destroyed the bank of the canal. An examination of the Official Gazette as far back as 1865 will bring forth much testimony as to the work done in this connection.

Annual Meeting of the American Institute of Electrical Engineers.

The annual business meeting of the Institute was held at the headquarters, 12 West 31st St., New York City, at 4 p.m. of Tuesday, May 16. The report of the council for the year ending April 30 was read and approved. The report shows a gain in membership of some 56 over the previous year, the full number now being as follows: Honorary members, 3; members, 206; associate members, 462.

There has been an unusually large number of deaths during the past year, and, probably from the unsettled state of electrical affairs, a large number of resignations. Many new men have been admitted and the Institute bids fair to increase steadily and rapidly in the future. The treasurer's report shows a balance in the general fund of $90.90, and in the building fund $850. At the election which followed there were elected to succeed the officials retiring at this time: Prof. Edwin J. Houston, president; H. Ward Leonard, P. B. Delany and William Wallace, vice-presidents; Chas. Hewitt, W. J. Hammer, Harris J. Ryan and J. J. Carty, managers; treasurer, George M. Phelps, and Mr. Ralph W. Pope was re-elected secretary. After adjournment the members assembled at the Arena to the number of seventy-five and enjoyed a very fine dinner followed by speeches by various well known members, among whom were Mr. T. D. Lockwood, Mr. Frankland Jannus, Dr. C. E. Emery, Mr. E. G. Willyoung and Mr. T. C. Martin.

The next day, Wednesday the 17th, the tenth general meeting was called to order in the forenoon at the headquarters and papers read on the following subjects:

1. **"On the Behavior of Fuse Metals in Direct and Alternate Current Circuits," by Mr. Charles P. Matthews, of Cornell University, Ithaca, N.Y.**
2. **"A Modified Deprez D'Arsonval Galvanometer, by Lieut. Charles D. Parkhurst, of Watervliet Arsenal, West Troy, N. Y.**
3. **"The Variation in Economy of the Steam Engine due to Variation in Load," by Prof. R. C. Carpenter, of Cornell University, Ithaca, N. Y.**
4. **"An Automatic Printing Speed Counter for Dynamo Shafting," by Prof. Geo. S. Moler, of Cornell University, Ithaca, N. Y.**
5. **"Practical Aspects of Electrical Resonance," by Dr. M. I. Pupin, of Columbia College, New York City.**
6. **"The World's Electrical Congress of 1893," Discussion of the Provisional Programme prepared by the Institute Committee. This report with its appendices has been printed in the January and February issues of the Transactions, and absent members are earnestly invited to contribute in writing any comments they desire to make.**
7. **"A New Method and Apparatus for Measuring Conductivity," by Mr. E. G. Willyoung, of Philadelphia.**
8. **"The Heating of Armatures," by A. H. and C. E. Timmerman, of Cornell University, Ithaca, N. Y.**

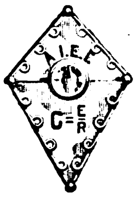
Many of the members in the evening attended the meeting of the New York Electrical Society at Columbia College, and listened to a paper by Dr. W. J. Morton on "A Brief Glance at Electricity in Medicine."

On Thursday, the 18th, about 75 of the members accepted the invitation of the Crocker-Wheeler Co., to visit its new factory at Ampere, New Jersey.

Prof. E. J. Houston.

The newly elected president of the American Institute of Electrical Engineers comes of a distinguished ancestry and has been for nearly his whole life identified with the school life of Philadelphia. Although interested in many other matters he still retains his position as Professor of Physics in the Central High School of that city. It was in this connection that Prof. Elihu Thomson was associated with him, first as pupil and later as assistant. It is only necessary to examine the files of the journal of the Franklin institute to learn the extent of the researches of both these gentlemen not only in electricity, with which their names have been so closely connected, but in many other matters. Of late years Prof. Houston has been prolific in literary work and his name is as prominent in that line as previously in invention. His "Dictionary of Electrical Terms" and his "Primers of Electricity" are as popular as any books in the science.

The Badge of the A. I. E. E.



The American Institute of Electrical Engineers has selected a design for a badge and trade mark that is unique in design and very appropriate. In the representation given herewith may be seen the general design. In form it is kite shaped, in recognition of Benj. Franklin, America's first electrician and philosopher. While on its face is a diagramatic representation of Wheatstone's bridge; the letters in gold A. I. E. E., the initials of the society's name; $C=\frac{E}{R}$ an important formula in electrical work and in the center a galvanometer, an important electrical instrument, made of amber, to the Greek name for which electricity owes its derivation. The pin is made of white enamel with the lettering and front portions in 18-karat gold and the back in 14 karat gold.

A BRIEF REVIEW.

Mr. D. Paul Schoop describes in the Electrical Engineer of recent date a process of preparing a gelatinous electrolyte for storage batteries which has many advantages over the dilute acid. This process has been tried in this country but not as successfully as in Europe, probably on account of some fault in the preparation which will not occur if this process is followed. Short circuits and much of the dirt usually attending the use of storage batteries are avoided. This gelatinous electrolyte is prepared from sulphuric acid, silicate of soda and asbestos fibre. The sulphuric acid which must be free from all impurities is diluted with three parts of distilled water. The silicate of soda must be prepared by a special process to free it from all foreign matter and the asbestos fibre is prepared by boiling asbestos mill-board in dilute sulphuric acid. The mill board disintegrates into a fine pulp which is washed and gently pressed when it is ready for use. Four gallons of the dilute sulphuric acid is mixed with one pound of the asbestos fibre and when evenly distributed one gallon of water glass is added and quickly stirred in. The solution should appear like ordinary dilute acid free from lumps. This should be stirred for some time until it gets thicker; when it has stood for an hour it will appear oily and is then ready to turn into the cell which should first have been washed with dilute acid. In 24 hours it will have become sufficiently thick so that the cell may be inverted without anything dropping out.

Probably in no part of the United States has the electric street railway been introduced so largely as in the New England States. To this subject the reports of the railroad commissions of the different states have devoted a considerable space. The Weekly Review says: "that in Connecticut alone over one hundred schemes are said to be on foot for connecting towns many miles apart, for freight as well as passenger service; also that the steam roads are naturally alarmed at the popularity of the idea and have appeared before the different legislatures to oppose the unrestricted grant of electric line privileges. The Connecticut farmer not realizing the advantages of the road is also somewhat hostile to the occupancy of the narrow wagon highways by electric roads but will undoubtedly soon see the advantages which the road affords him." Mr. Franklin L. Pope says in the Engineering Magazine that "some of the state legislatures are making a grievous mistake in granting charters indiscriminately to interurban electric railways and giving them the free use of the public highways without the payment of a franchise tax for the privileges thus bestowed. Although many of the different horse railways which have been equipped with electricity have been successful financially, it does not follow that every road five or ten miles long with a traffic requiring an hour, or half hour trip can be operated by electricity with benefit to the stockholders. The craze for covering the rural districts with a net work of electric railways is being fostered by the manufacturers of electrical apparatus and so long as the public can be induced to purchase bonds to pay for these prospects' so long will enterprise and prosperity go hand in hand."

The exact knowledge that we possess of electricity is limited but whether this lack of knowledge hinders us in its utilization to any great extent is a question not easily settled. Our present knowledge has been gained by experiments, by watching the effects together with computations based on data secured from previous experiments and has been gradually built up. Mr. Kennelly in the conclusion of his recent article on impedance says: "This paper has been written with the endeavor to point out that the difficulties which at present enshroud the use and the working theory of alternating currents are largely fictitious. An alternating current circuit is certainly a very complex thing; but so is a dynamo, and we can predetermine dynamos with a degree of accuracy sufficient for all practical purposes. We know when a machine is designed, within reasonable limits, what the voltage will be at its terminals when driven at a certain speed, with a certain excitation and load, although the exact calculation would transcend all the capabilites we possess at this day. Similarly, theories which are sufficiently good for most practical working purposes run through all kindred sciences, whereas the exact theories are beyond present human capabilities; and although alternating currents are so difficult when studied accurately and absolutely, the working theory of alternating currents can be made as simple as the working theory of continuous currents. I am firmly impressed with the belief—a belief which I trust I may be able to communicate—that the most convincing way of proving that this difficulty which has surrounded the alternating current and its distribution, can be eliminated and removed is by the development of the notion of impedance."

We quote from an article regarding the Thomson Electric Welding Co., in a recent number of the United States Investor, substantially as follows: "There seems to be more than the usual amount of mystery surrounding the actions, intentions and prospects of the Thomson Electric Welding Co. What has become of all the grand possibilities that were held up to the public some few years ago? The readers of the Investor will probably agree, after they have become acquainted with a few of the circumstances that exist in connection with the Thomson Electric Welding Co., that electric welding is not dead but sleeping. The would-be purchaser is informed that he cannot purchase an electric welding machine, he can only lease it—has to pay down in cash a sum of money; must pay a guaranteed rental; must be bonded by well-known men for a certain amount; must pay a royalty on every weld made, and further must pay 30 per cent of the profits made by the use of the machine. What is more evident than anything else is that they do not want to sell their machines. The Thomson Electric Welding Co. are not in the market to do business, but to run their stock down to the lowest point possible.

"The Thomson Electric Welding Co. is not on the verge of bankruptcy; in fact it is perfectly safe, and is reported not to owe a dollar. It has some finely equipped shops at Lynn, that are kept going partly on welding machinery work, but mostly on work supplied by the General Electric Co. It had always been a mystery to the writer why, if the art of electric welding was a failure, the company should retain its engines, shops, etc., why it did not go out of business or profess some other business. The man who takes upon himself to state that electric welding is a failure, does not know the circumstances that point otherwise. It would be ridiculous to imagine that men who are capable of doing business, would continue to rent, use and pay royalties on a machine that is a failure; it looks as though it must be a decided success, or these lessees would have returned the welding machines to the Thomson Electric Welding Co. It is extremely difficult to find persons who, willingly, continue doing business at a loss. When one looks back to see what has been done, looks at the present and remarks the solid standing of the welding company, everything points to either one of the most peculiarly arranged companies that ever existed, or to a deep-laid scheme and to the most shrewd financial management."

One point that the writer of the above has not brought out, is, that with very few exceptions each welding machine is designed especially for the purpose for which it is used, and from this fact is rendered very costly, so much so that it is a question if the firm wanting such a machine would not be scared off at once by a price which would cover cost and a fair profit. These machines cannot be built like dynamos, lathes and sewing machines in which one set of drawings and patterns do for thousands, and where, by making many similar pieces the labor is reduced to a minimum.

Although the conditions of the contract, as stated above, certainly do appear to be very hard on the lessee, it will probably be found that this contract was drawn up by the same attorneys who laid the foundation for the success of the well known shoe machinery for sewing on buttons and for other work, and which are rented in a very similar manner and have been found very profitable not only to the owners but to the lessees. The Bell Telephone methods and lease were evidently modeled on the same form if not by the same attorneys. Both the telephone and shoe machinery are inexpensive as compared with any welding machine, and can be made up by the thousands all on the same patterns. The fact still remains that the welding business seems to have taken a slump; why is it?

In the matter or insulation of electrical conductors many improvements have been made as the demand has increased for better insulation; but that there is still an opening for an insulation which will not be affected by a high degree of heat no one will deny. Mr. Julian Moses in a recent article in the Electrical Review, says that "the insulating compounds are meriting the success they are having, for their convenience is obvious; they are filling a growing want, but unfortunately they are more or less fragile, and strange to say, it would appear that the predominant disadvantages of the many 'best' insulators that are in the market is their inflammability."

And further, in substance, the many wrappings of cotton, silk, etc., have been so protected by the introduction of various salts that they will not burst out into flame under temperatures at which they would ordinarily; but the prevention of a rapid burning does not prevent a slow consumption and its attending evils. The one thing needful is a perfectly incombustible material; mica and asbestos pressed into a solid form with the admixture of some adhesive substance answer in a measure. But its resistance to the action of heat is limited to the resistance of the adhesive mixture itself which is often a hydrocarbon and will melt or char almost as quickly as some of the so-called non-inflammable tapes.

The use of tubular conduits of insulating material is a great protection, and also surrounding the insulator with a metal covering. An excellent insulator is formed in water glass when dry; it is an incombustible and glutinous chemical and changes to an indestructable compound of silicon when subjected to much heat. It may be used as a binder with shredded asbestos which forms a perfect insulator.

Some very good ideas and interesting figures on the cost of putting electric wires under ground are given in an article in the Engineering News from which we take the following:

The type of electrical subway which is principally used and has been most successful in New York City, consists merely of a number of wrought iron tubes two to four inches in diameter, laid in a trench and surrounded by concrete. The number and diameter of the tubes depend upon the number of wires to be accommodated, but as a rough guide it may be said that one three inch tube will accommodate 200 or more telephone, telegraph or messenger wires or a half dozen high tension electric wires. In general the wire on which a battery is used, should be placed on the opposite side of the street from the electric light wires or at least the tubes containing the two kinds of wires, should be placed as far apart as possible. Manholes for making service connections and to permit the cables to be drawn into the tubes, must be placed at intervals of from 250 to 500 feet. Given the complete designs and specifications an engineer or contractor accustomed to city work can figure very closely on the cost of the pipe, concrete, trenching and manholes which are required.

The cost of New York City's electrical subways per duct per mile has been given as about $3,000. But it must be remembered that the cost of such work in New York City is higher than it would be or ought to be in most other cities. New York subway companies spent a large amount of money in experimenting and the uncertainty of the enterprise at the outset should warrant the investors in receiving a good return for their investment. Mr. Wm. H. Brown states in a recent paper that with the experience accumulated since the New York subways were begun, the accommodations of the New York Electric Lighting companies could be duplicated at 25 per cent. of their cost. There is no reason now why the cost of putting wires under ground should be anything appalling even in the very small cities and in scattered suburban towns. As an example, suppose we estimate the cost of a subway on a residence street where the number of customers is so small that one 3 inch duct on one side suffices for electric light wires and a 2 inch duct on the other accommodates all the telephone, messenger, etc., wires. With twelve manholes on each subway we have then, one mile of three inch pipe at 38 cts. per foot 70 per cent discount, $602, one mile of two inch pipe at 25 cts. per foot less 70 per cent discount, $396, two miles of concrete net section 22 sq. ins. at $8 per cubic yd. $480, 24 manholes at $25, $600, trenching back- filling and laying concrete $350; total $2,428.00.

Thus the first cost of the subways per mile may be placed at $2,500 or 25 cts. per foot frontage on each side of the street, that is for every 50 ft. of frontage $12.50. But suppose one resident in eight takes service then we have the first cost charged to each customer $100. Taking the interest and depreciation at eight per cent. we have the annual subway charge to each customer of eight dollars. But should the customer pay all of it; is not the company greatly benefitted? In addition to the great decrease in cost of maintenance there is the renewal of poles, the rental of roofs, the damage caused by interruption of service due to storms or to damage to machinery, damages caused by injuries to wiremen or interruption to traffic, caused by the falling of wires or poles, all of which are avoided in the subway.

At the meeting of the New York Electrical Society held on May 7th at Columbian College, Prof. Crocker delivered a lecture on dynamotors or direct current transformers, the dynamotor performing for the direct current what the transformer does for the alternating.

The history of the dynamotor was first taken up. The use of a dynamo and motor acting together on any system of distribution being considered identical in principle with the dynamotor, and was the first application of the principle. The next step in the development was the combination of the two in one machine. Gramme in 1874 announced to the French Academy that he had a machine of this type in operation, in which a single armature core was used with two windings, each of which was connected to a separate commutator. Cabanellas in 1881 also gave some attention to this idea and in 1882 Lane-Fox patented a system in England, a system of conversion of high to low tension currents intended for general distribution. A number of others worked on the same line among them, Zipernowski, Deri and Edison.

A noticeable fact in connection with the running of a dynamotor is that the point of commutation is exactly in the center line passing between the pole pieces, and remains there for all loads and thus needs no adjustment, as the load varies, as in the dynamo or motor: the latter requires a backward lead and the former a forward. In the dynamotor the two amature reactions counterbalance each other and the line of commutation remains fixed.

In treating of the efficiency of these machines Prof. Crocker pointed out many important facts. It is difficult to make a machine of this character as efficient as either the motor or dynamo for while the motor and dynamo may each have an efficiency of 90 per cent; when we combine the two the efficiency of the entire machine will not have an efficiency of over 81 per cent but if especial care is taken in designing the machine the efficiency may reach 85 per cent in large machines. Among the advantages of this type of machines are the reduced friction; the almost total neutralization of self induction, the great reduction of parts and consequent cost and also the smaller space occupied.

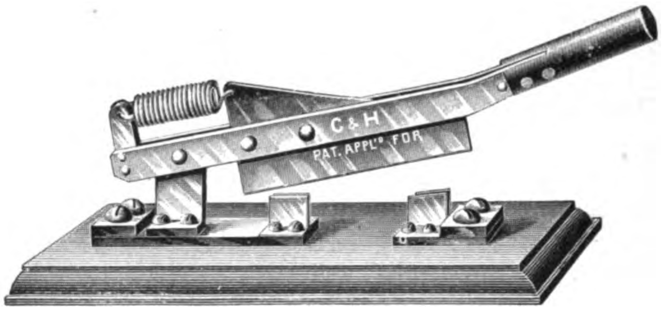
A number of dynamotors were exhibited in operation, increasing and decreasing the voltage of currents. Reference was made to the uses to which the dynamotor may be put, such as the reduction of the 500-volt railway currents for incandescent lights; for electro-plating; for telegraphy where currents of different tension are required; for use in connection with the telephone. In its future development many new uses will undoubtedly be found for it.

Decision on Fixture Patents.

An important decision has been made by Judge Coxe, of the United States Circuit court, in reference to various Edison patents on fixtures, sockets, etc. The Edison Electric Light Company et al. brought suit against the Equitable Life Assurance Society for infringement of these patents. The court, in giving its decision, remarked that inasmuch as the alleged infringement was commenced eleven years ago and had continued up to the present time, with no attempt on the part of the plaintiff to collect license fees, or an attempt to restrain the defendant, the Edison company was not entitled to a restraining order or apermanent injunction.

The C. & H. Switch.

The demand for a knife switch that will open the circuit with a positive, long, quick break is met in a very simple manner by the "C. & H." switch herewith illustrated. The construction is still further simplified by using rolled brass and copper bars throughout, instead of castings as is usual in most switches. They present a neat and attractive appearance and can be had in a great variety of styles and sizes from 15 to 2,000 amperes. The switch was invented and carefully worked out by Mr. H. H. Cutler, of the firm of Cutler & Hammer, Chicago, who are placing the switches on the market, and will exhibit them at the World's Fair.

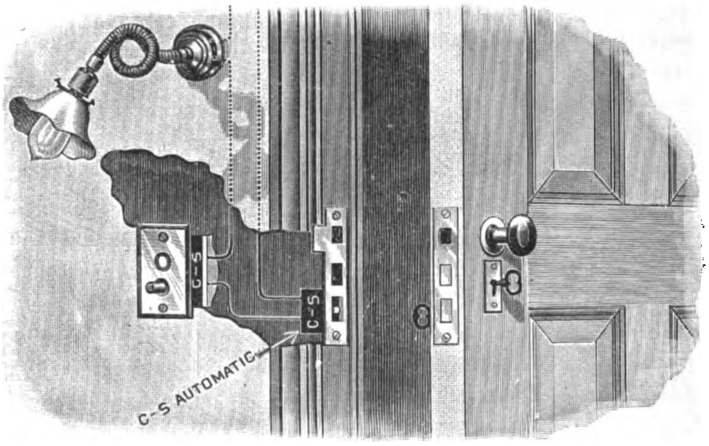


THE C. & H. SWITCH.

A Novel Application of the C. S. Automatic Switch.

Among the many expenses in connection with a hotel none are so greatly augmented by the negligence of guests as that attendant upon lighting the rooms and this is particularly noticeable where electric lights are used. It is estimated that nearly 90 per cent of all hotel guests invariably leave their lights burning upon vacating their rooms.

Hotel managers have for some time been trying to devise a remedy for this evil which has become so general, but thus far the only way has been to keep a constant watch on the rooms. By the novel application of the C. S. automatic switch this evil is, it is claimed, eliminated, for the lights are turned off upon leaving a room whether the guest thinks of it or not. In the modern hotel the doors are usually fitted with secret or double bolt locks, one bolt being operated from the inside, the other from the outside and by taking advantage of this fact the C. S. switch is made to perform its service of economy in the most successful manner. As shown in the illustration this switch is placed in the moulding of the door immediately back of the stricker plate, in such a manner that the push of the switch is directly in line with the movement of the bolt that is operated from the outside of the room.



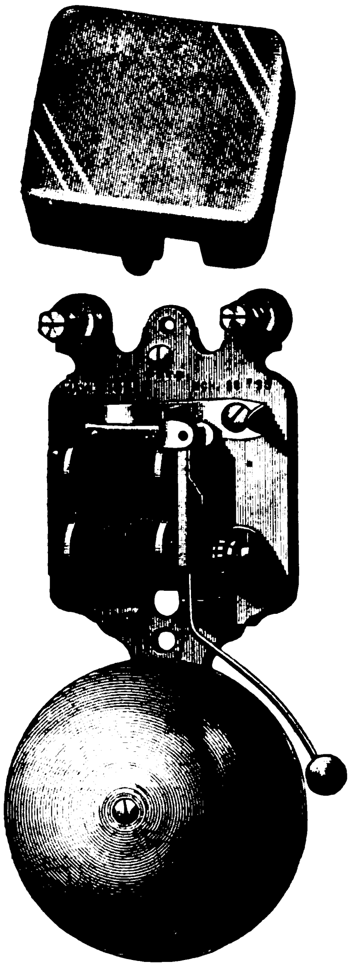
A NOVEL APPLICATION OF THE C. S. AUTOMATIC SWITCH.

Thus it will be seen that by the locking of the door from the outside the switch push is pressed in and the switch opened thus putting out the light, while it is not affected by the locking of the door on the inside. In order that the guest may turn on or off the light while in the room when desired an auxiliary switch is placed inside the room, in the circuit between the controlling door lock and the lamps in such a manner that while the door remains unlocked from the outside the lamps may be turned on or off at will.

This ingenious device has recently been added to the stock of C. S. specialties manufactured by the Cutter Electrical & Manufacturing Company, Philadelphia. The Great Northern Hotel, Chicago, has recently been fitted with these switches and they are now being placed in a number of other hotels.

A New Electric Bell.

A new electric bell which, although it resembles very much in outward appearance the ordinary bell, contains a number of new and valuable improvements which have been recently patented by F. W. Manger and O. H. Huebel of 286 Graham st., Brooklyn, N. Y.



NEW ELECTRIC BELL.

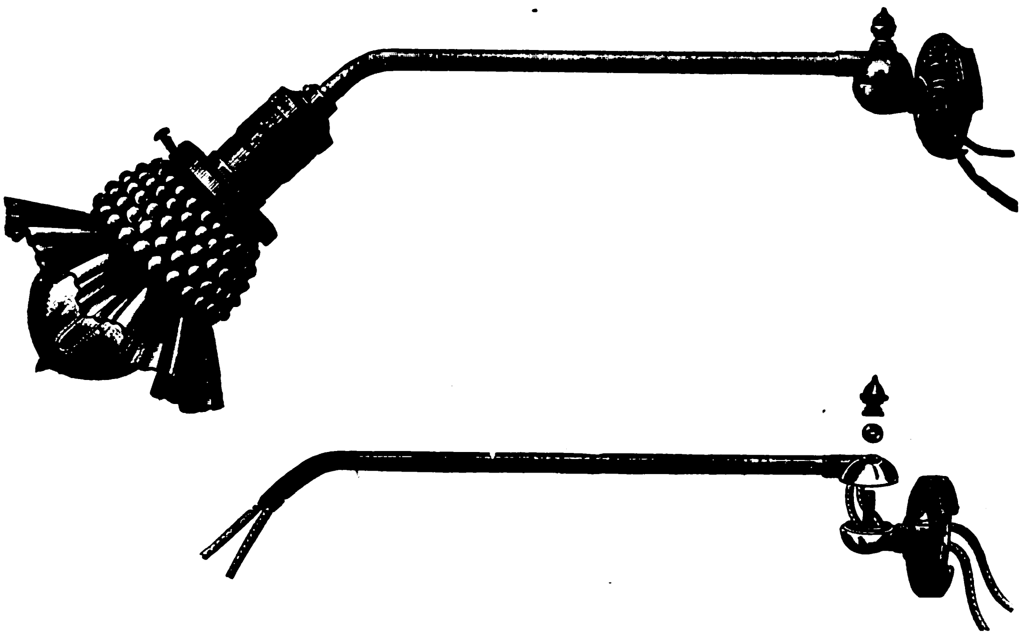
These improvements have made the bell very durable and reliable. In fact, in its construction special care has been taken to make the mechanism as substantial and reliable as possible. Among the improvements noticeable are those made in the construction of the binding posts. Platinum washers are used in the contacts and are riveted instead of being soldered. The binding and adjusting posts are set in square slots in the base which prevents their turning. Grooves are provided on the back of the base for the reception of the leading in wires. The cover may be easily removed by simply loosening a screw which allows it to be detached without taking the screw entirely out.

The cores of the magnets are riveted to the usual raised supports at right angles to the base and under one of the flanges which holds the magnet spool in place is secured the pivotal mounting. There are two springs, as usual, one for the electrical contact and the other for adjustment which are secured to the armature by the same rivets. The end of the contact spring is rolled to form an eye which pivots on the mounting above mentioned. The end of the adjusting spring bears against a movable adjusting piece, thus enabling adjustment to be easily made in any possible position.

In the use of square washers in a rectangular depression under the binding posts another improvement has been made which enables the terminal wires to be secured without danger of being twisted off as is often the case when circular washers are used. These bells are made with either wood or iron covers as desired.

The Globe Electric Swinging Bracket.

There has just been perfected and placed on the market an electric swinging bracket having several decidedly important features in its construction. It is manufactured and sold by the Globe Light & Heat Co., 54 Lake St., Chicago.

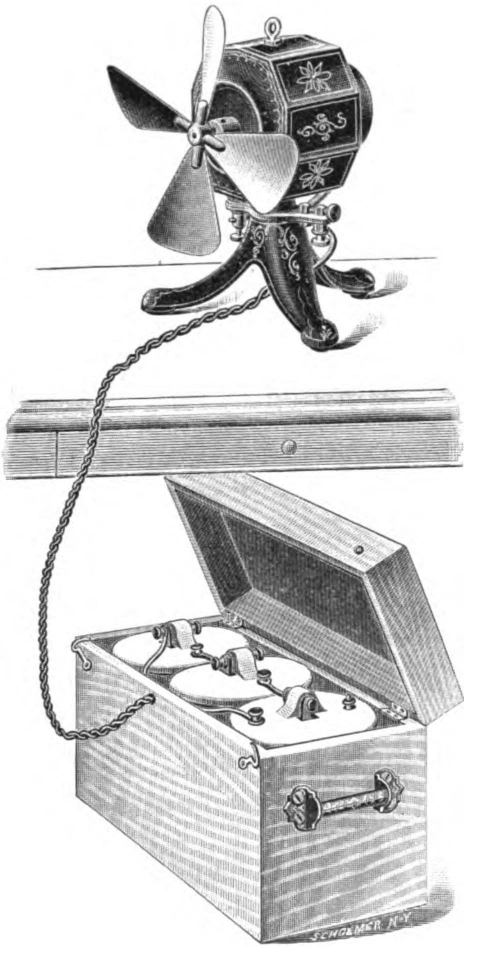


GLOBE ELECTRIC SWINGING BRACKET.

It is exceedingly simple in its construction yet it is very substantial and durable. The most important part is the swing joint by which the bracket is enabled to turn to any angle from the wall. It consists of two half globes, one fastened permanently to the flange, with a shaft passing through the other half and fastened by an ornamental knob and flat washer. When screwed together it makes a perfect joint. It is easily and quickly wired, the joint giving plenty of room for sufficient loose wire so that in turning the bracket there is no strain and consequently no wear of the wire. If after long usage the half globes of the joint should become worn they may be tightened up as firmly as when new by the ornamental knob. Being very simple in construction the brackets are placed on the market at a very reasonable price. By the use of a double joint of this character the lamp may be raised or lowered as well as swung from one side to the other.

The Edison New Iron Clad Fan Motor.

For some time past considerable attention has been given to the construction of fan motors that could be run by low potential currents such as are generated by primary batteries. In the accompanying illustration is shown one which has been designed for a current of two amperes at one and one-half volts. Such a current will run a seven inch four bladed fan at 1,000 revolutions per minute. This fan motor with the battery which consists of three Edison-Leland cells, placed in a well made and nicely furnished oak box requires but little space and is easily moved. The capacity of the battery is 150 ampere hours with practically no loss when the motor is not in use. The armature of the motor, as suggested by the motor's name, is entirely enclosed in an iron box with a glass window at one end through which the brushes and commutators may be inspected. Its bearings are self oiling and carry on their own lubrication without loss of the lubricant. The oil wells need refilling only when the battery is recharged. This arrangement, as well as the enclosing of the motor, insures the neat use of the fan without any attending dirt or oil. It may be placed anywhere about the room and makes an attractive ornament. Among the many advantages of this iron clad motor is its compactness, safety, noiselessness, cleanliness, and efficiency. For country villas, city residences, steamer cabins, etc., the fan will be greatly appreciated.



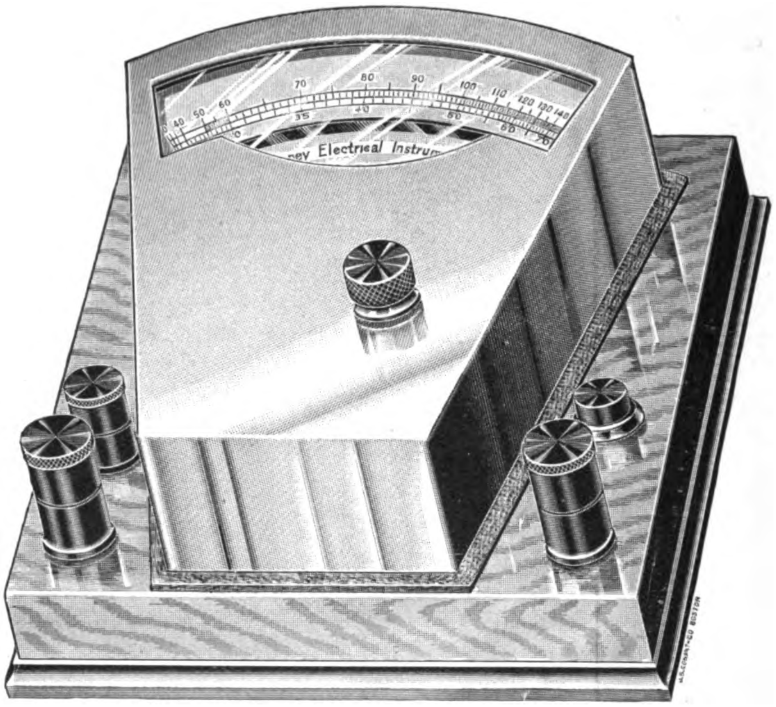
EDISON NEW IRON CLAD FAN MOTOR.

The cost of operating the machine amounts to about two and three-fourth cents per hour and any repairs or adjustments are quickly and easily made by sliding the glass window which covers the end of the armature. These fan motors and batteries are manufactured by the Edison Manufacturing Company, 110 E. 23rd St., New York.

New Whitney Alternating Current Instruments.

The new Whitney instruments for alternating current work are very finely constructed and will undoubtedly find a ready sale. The alternating current volt meter has an almost uniformly divided scale guaranteed absolutely accurate for the most careful measurements on any alternating current, being unaffected by variations in frequency.

This has been a difficuty that has been successfully overcome in the manufacture of these instruments so that it is not necessary to recallibrate each instrument for the particular machine on which it is to be used, thus the Whitney instruments can be used on any kind of an alternating current machine with accuracy. The uniform divisions of the scale is a point to which particular attention is called. Improvements in this respect are being continually made and the volt meter scales as now divided are even more uniform than is shown in the accompanying cut. The 0 to 75 scales read from 15 to 20 in one volt divisions and from 20 to 75 in one-half volt divisions. The 0 to 150 scales read from 30 to 40 in two volt divisions and from 40 to 150 in one volt divisions. The double scale instrument combines both of the above scales and reads in the same way.



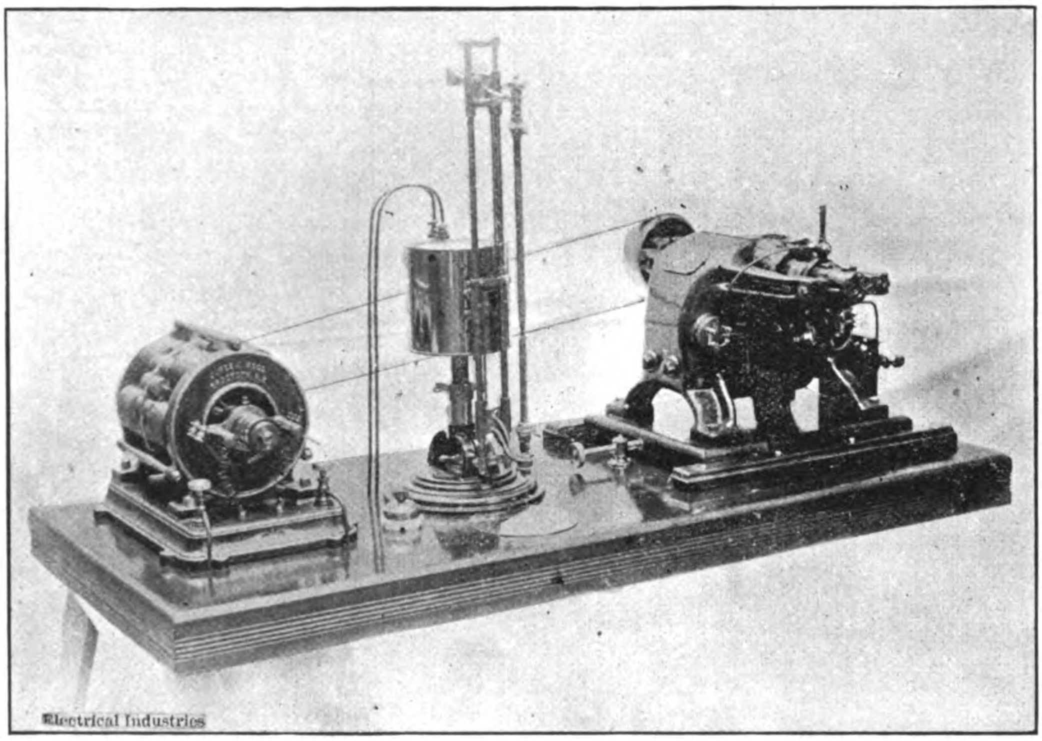
NEW WHITNEY ALTERNATING CURRENT INSTRUMENTS.

In the production of a perfect ammeter the Whitney company have been very successful as the instruments manufactured are reported very accurate in measuring the alternating current. In the past, for the measurement of alternating currents it has been necessary to use a dynamometer, which is cumbersome and unhandy to use, in order to secure an accurate measurement of the alternating current. This alternating ammeter is guaranteed correct and perfectly satisfactory. They are made reading as low as one-twentieth of an ampere in the small sizes, with correspondingly small divisions for the larger sizes. These instruments are reasonable in price, and already large sales are reported. The Electrical Appliance Company, 242 Madison street, Chicago, are the western agents for the Whitney company.

An Early Dynamo.

A very interesting feature in the exhibit of the Fort Wayne Electric Company at the Fair is a small continuous current dynamo designed and built by Mr. Jas. J. Wood in 1879 for the Fuller Electrical Company of New York City, Mr. Wood at that time being the mechanical and electrical engineer for that firm.

The dynamo received a medal of superiority at the American Institute exhibit in New York City in the fall of 1880; it weighs only 86 pounds and at 1,700 revolutions per minute will deliver 10 amperes of current at 50 volts. The armature is ventilated, iron clad and is composed of a number of separate coils. The field magnets are multipolar and are cast in one piece, the bearing being a part of the casting. The mechanical construction compares very favorably with machines of today. The internal resistance of the machine is but one ohm and it is therefore very efficient. Another unique feature is the interlocking commutator which is so constructed that the machine may be run as a self exciting alternator, a tri-phase generator, and a direct current dynamo from which three independent circuits can be run at the same time.



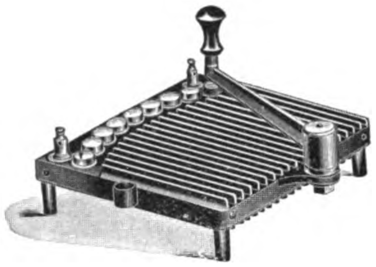
AN EARLY DYNAMO.

Changing from one to the other of these systems requires but a few moments. Considering the time at which the machine was built this is probably one of the best mechanically and electrically constructed machines ever made. The machine is now being driven by one of Mr. Wood's latest motors and furnishes current for one of his large focusing lamps.

A New Style of Rheostat.

While all the other parts of electrical machinery have been vastly improved during the past few years, the motor starting boxes, rheostats, field regulators, etc., have hardly kept pace with the general advancement. In resistance devices the principal thing to be considered is the carrying capacity of the resistance wire used which is limited to such capacity as the wire will carry without harmful heating.

The ultimate temperature of a wire depends on its ability to dissipate the heat generated by the passage of the current through it, and if by any means we can increase its power of dissipating the heat we will increase the efficiency in the same proportion as the capacity of the wire. It is obvious that if we enclose the wire in an electrical non-conductor that has a large radiating surface exposed to the air the desired result will be gained.



A NEW RHEOSTAT.

It is this principle that is employed in the construction of this new style of rheostat. The resistance wires are embedded in a solid plate of insulating material which is completely incased by and in immediate contact with an iron covering. This iron covering having a fluted surface presents a very large proportionately radiating surface and the wire being but about one-sixteenth of an inch from it remains cool under a considerable current. Thus its carrying capacity is largely increased without decreasing its resistance per foot which enables the makers to work a wire of short length, of large carrying capacity and of great resistance. The entire shell being of metal the instrument will stand unharmed a large amount of rough usage and wear. The contact pieces, binding posts and levers are firmly attached to the metal case from which they are protected by an insulation of mica. The connections with the wires are made within the plate of insulating material while it is in a plastic condition so that no part of the wires or connections is exposed to the air in the completed device.

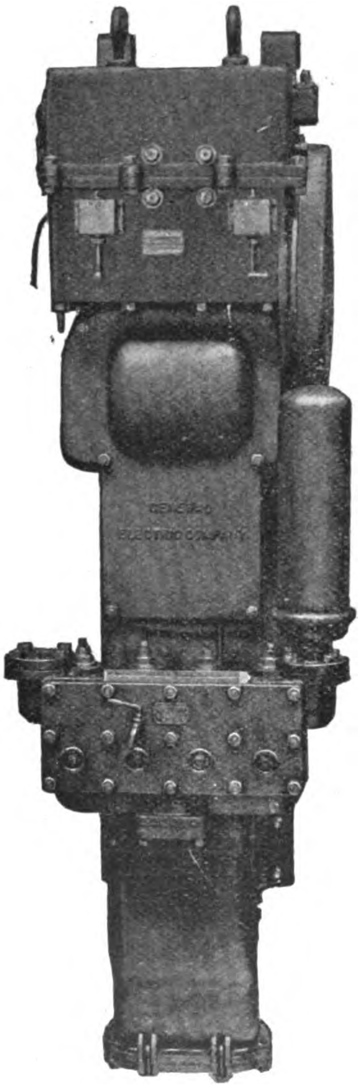
There has also been constructed an automatic release for motor starting boxes which is quite ingenious and agreat protection. These devices are manufactured and sold by

McDougall & Cummings, Unity building, Chicago, who make a specialty of resistance work. These rheostats, starting boxes, etc., are made in different sizes for different voltages, are incombustible, compact and reasonable in price.

Duplex Electric Sinking Pump.

In the accompanying illustration is shown a pump which is light in weight, compact in form, efficient and not liable to damage from moisture or hard usage, thus overcoming many of the difficulties heretofore experienced in the use of pumps of this kind.

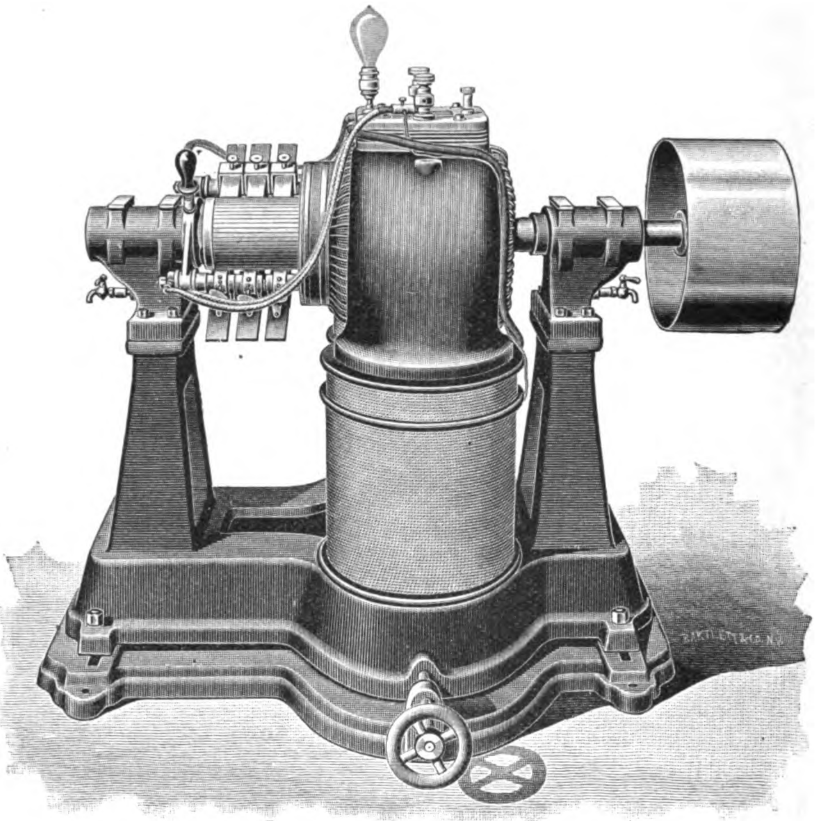
The pumps are operated by an electric motor with the gearing and operating mechanism enclosed in a cast steel casing and absolutely water tight. It is of the duplex double acting type, with outside packed plungers, and is so constructed that all the wearing parts are easily accessible for examination and easily replaced. The only moving parts visible are short sections of the plungers and rods. This pump is not easily damaged by water, and will stand considerable hard usage. It is said that it will work as well under water as out of it, and that the cooling action of the water increases the efficiency of the electric motor. If thoroughly well insulated cables are used for conveying the electric energy to the pump, it can be submerged by a sudden rush of water in the line and still continue to operate. The motor is placed in the upper part of the case within a water proof chamber separated from the gearing and other parts, so that should the outside case leak the motor would still run.


DUPLEX ELECTRIC SINKING PUMP.

The pump is so constructed that it is not easily injured or cause injury to those working about it. It is economical in the use of power and has a very high efficiency, having a capacity of 125 gallons per minute against a vertical head of 200 feet. It occupies a space of only 24 inches by 26 inches by 86 inches, and weighs complete about 3,000 pounds. They are manufactured of various sizes and are placed on the market by the General Electric Company of Boston and New York.

New La Roche Direct Current Dynamo.

In the accompanying cut is shown a new type of direct current dynamo built by the well known La Roche Electrical Works, of Philadelphia, Pa. It has been designed by Mr. F. A. La Roche and has given great satisfaction. The machine, as will be noticed, is of the motor type with Gramme ring armature of the latest improved construction. It is a compound wound machine, and the windings are made in such a way that any of the coils can be renewed and replaced without interfering with any other part of the machine. In fact, all parts of the machine are interchangeable and of an improved pattern. It has self oiling bearings and automatic overflow; the shaft is of extra heavy steel which does not allow any vibration, thus permitting the armature to run very close to the pole pieces, consequently increasing the efficiency of the machine. The brush holders are of a new design by which a perfect adjustment of the brushes can be made and also permits the free movement of the brushes around the commutator. This commutator is of specially hardened copper well insulated by sheet mica and firmly secured in place. The general construction of the machine is such as to make it very durable and able to stand a considerable hard usage without injury. At a recent test of one of these machines, it was shown that there was a variation of only one and three-tenths volts between no load and a full load which is a reg-


NEW LA ROCHE DIRECT CURRENT DYNAMO.

ulation sufficiently close for all purposes to which a dynamo is put. Within the last three months the company has installed 15 of these dynamos in Philadelphia and vicinity.

An Electric Percussion Drill.

At the lime stone quarries of the Solvay Process Company near Syracuse, N. Y., there has been in operation for several months electric percussion drills that have given excellent results both for the work done and the convenience and economy of their operation, with which the company has been thoroughly satisfied.

These drills were installed by the General Electric Company at the commencement of the past winter and were in operation during the cold weather at times when the loss in the operation of a steam drill through condensation and radiation would have prevented its use. These drills were operated without any interruption during the cold weather. The quarry, as will be seen from the cut, is situated in an open spot on an elevated plateau where the intense cold would be felt severely. Three of these drills are now in continuous operation ten hours per day drilling holes two and two and one-half inches in diameter six to ten feet in depth. According to the record kept by the superintendent the rate of drilling is from 45 to 75 feet for the 10 hours day. The average distance of the drills from the power station is about 2,000 feet the circuit being extended to the distance of 3,000 from the power station in one direction. The wire used is of bare copper No. 0.

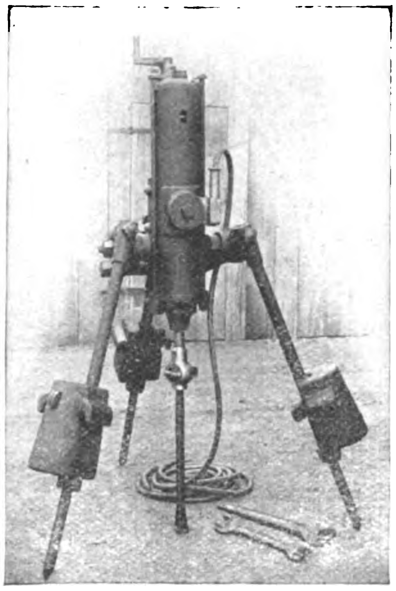


FIG. 1 —ELECTRIC PERCUSSION DRILL.

In their operation the drills are as easy and simple in every respect as the steam drill, the stopping and starting being accomplished by merely shifting a lever and in the lubrication of the wearing parts no difficulty is found. The general dimensions of the drills are, length over all 49 inches, outside diameter seven and one-half inches, length of stroke five to seven inches, rate per minute 380 strokes. At the power station for supplying power for these drills there is situated a generator running at normal speed and provided with a device for directing the current alternately into the upper and lower coils of the drills. The difference of potential at the brushes is from 240 to 250 volts. This generator is belted to a nine by twelve inch horizontal engine supplied with steam at 90 pounds pressure from a horizontal tubular boiler. Fuel is brought up to the power station in the buckets used on the cable way for transporting the rock to the works. This quarry plant has been inspected by a number of quarry owners among whom it has aroused a considerable interest and confidence in the use of electricity for driving drills.

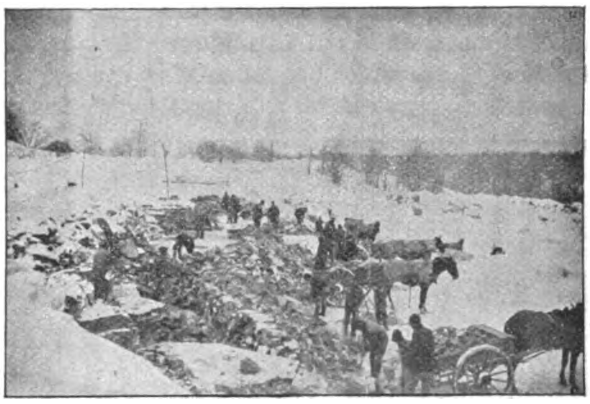
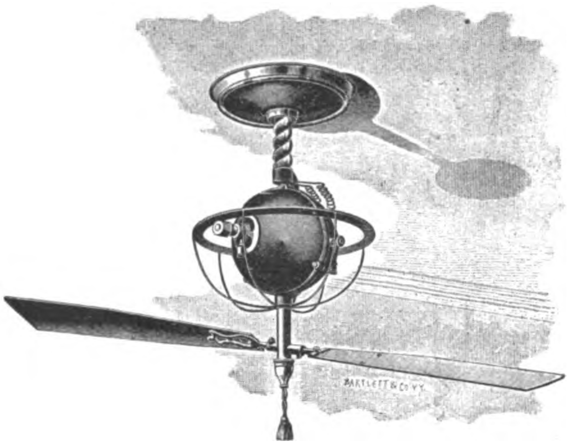


FIG. 2.—ELECTRIC PERCUSSION DRILL.

The Lundell Ceiling Fan Motor Outfit.

In the accompanying illustration is shown a fan motor outfit, the invention of Mr. Robert Lundell, which is novel in shape as well as in construction.

It can be attached to any ceiling at any desired height for giving any degree of breeze from a heavy blast to a light gentle breeze. The method of transforming the motion of the commutator shaft into a motion at right angles to it is interesting and is shown in the accompanying illustration. On one end of the motor shaft a small friction wheel is attached upon which rests a circular ring plate that encircles the motor and receives its motion by friction from the small wheel. This circular plate is fastened to the fan shaft by a number of curved metal braces that make a solid and strong construction.


LUNDELL FAN OUTFIT.

This motor is decidedly compact in form, very durable and strong enough to drive at a high rate of speed a large two bladed fan. These fan blades are made of hardwood polished and can be regulated to any desired pitch by the set screws near the centre shaft. Only about as much current is required to run this fan as is required for an ordinary 16-candle power lamp. Economy with the desired durability and efficiency are found in this fan motor outfit. They are manufactured by the Interior Conduit & Insulation Company, 44 Broad street, New York. The Central Electric Company, 118 Franklin street, Chicago, is the western agent.

In the last issue a mistake was made in the heading of the illustrated article on the new wood dynamo, which should have read "New Wood Alternating Dynamo."

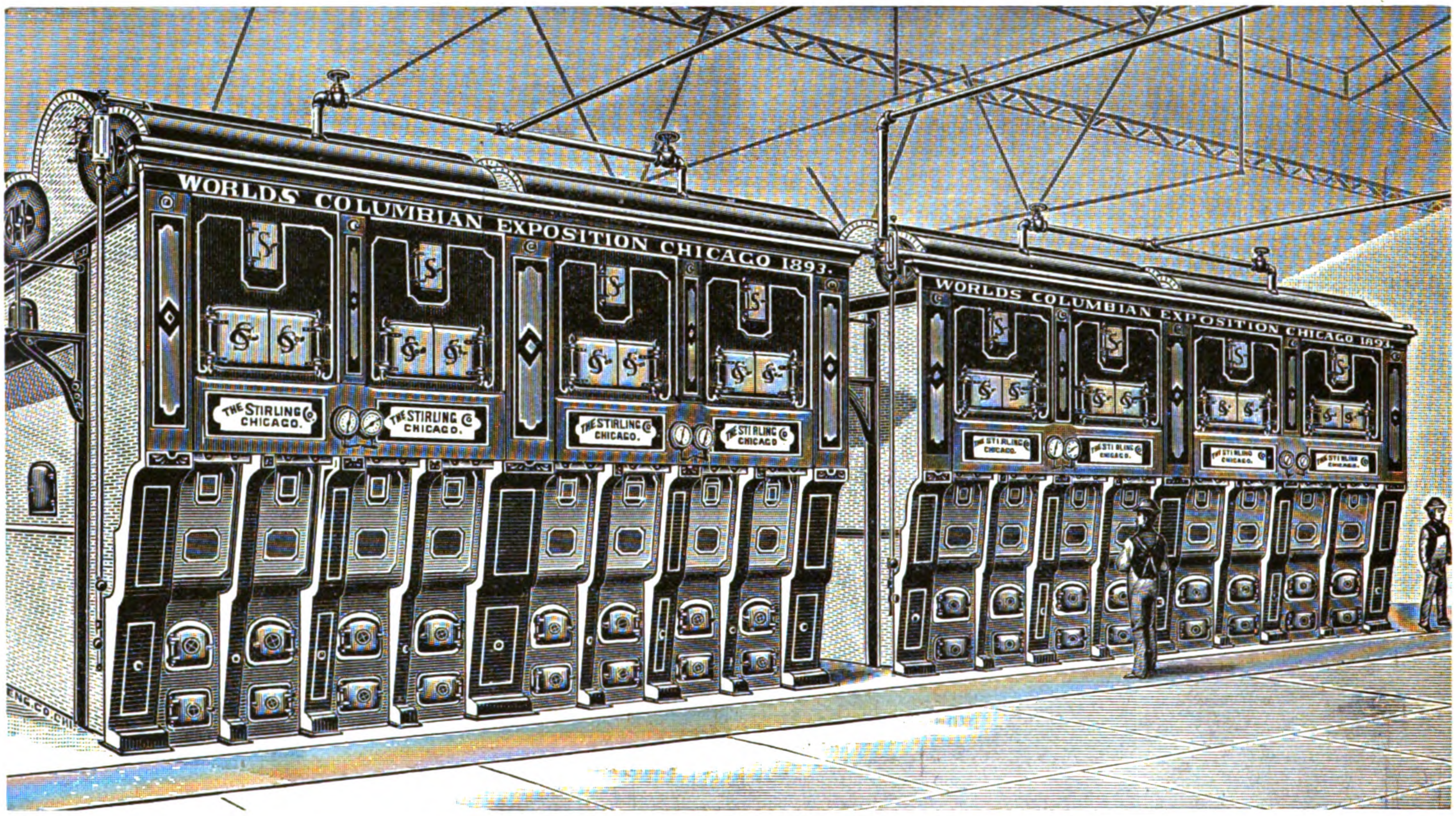
The Stirling Company's Exhibit at the World's Fair.

Toward the west end of the long row of boilers in the boiler plant in Machinery Hall, before which the visitor stands unable to comprehend the enormous amount of power generated, and unable to compare it but indefinitely with any boiler plant he has ever seen, stands part of the exhibit of the Stirling Co.

The boilers in this exhibit are guaranteed to evaporate 54,000 pounds of water an hour and immediately attract the visitor's attention on account of their white color; and as he stands before them they seem to impress one with their hidden power. In the Machinery Hall Annex are two boilers of the same size and capacity as those in the main boiler room, while out in Midway Plaisance in the Libby Glass Works which has attracted so much attention and received so many visitors watching the manufacture of glass is placed a battery of Stirling boilers having a combined capacity of 400-horse power. Thus the combined exhibit has a guaranteed evaporation of 94,500 pounds of water per hour or very nearly 1,000,000 for a day of ten hours.

These boilers were erected on solid foundations of brick and concrete and were built without the use of cast iron or cast steel in their construction which together with the manner of construction make them one of the safest of boilers. Before they were put in they were tested by a cold water test to 200 pounds which leaves a wide margin of 30 per cent when working at 150 pounds pressure. This high pressure is one of the interesting features as the demand for high pressure steam in connection with modern engines is increasing. In construction the boiler consists of a large drum placed back of the furnace from which the water tubes rise to the three drums placed above. The position of the tubes is noteworthy for by it the tubes are kept free from all impurities which are precipitated by the heat into the mud drum placed back of the furnace grates. Where the tubes enter the drums they are so secured as not to be affected by expansion and contraction and the longitudinal expansion will not injure them owing to their peculiar shape. The boilers are all supplied with oil burners for burning petroleum and although these boilers occupy little space in proportion to their capacity, they have a large draught area; the vertical position of the tubes and the arrangement of the brick baffle plates in the large tube chamber insures a good draught at all times. The special construction of the fire brick arch over the furnace with the wide draught area causes the gases and air to thoroughly mingle so that a perfect combustion is insured.

Thorough circulation takes place in the boiler due to the fact that each water tube being expanded directly into the circulating drums has a separate outlet equal to its own area. Although these boilers, owing to their peculiar construction require little cleaning, abundant and ample openings are provided so that easy access can be had to any and all parts of the boiler. The makers of this boiler call attention to four features in its operation, its safety, efficiency, economy and durability. This exhibit has already attracted considerable attention and visitors will undoubtedly be greatly interested in watching its practical operation and studying the peculiar features of its construction.


WORLDS COLUMBIAN EXPOSITION CHICAGO 1893.
THE STIRLING Co CHICAGO.
WORLDS COLUMBIAN EXPOSITION CHICAGO 1893

THE STIRLING COMPANY'S EXHIBIT AT THE WORLD'S FAIR.

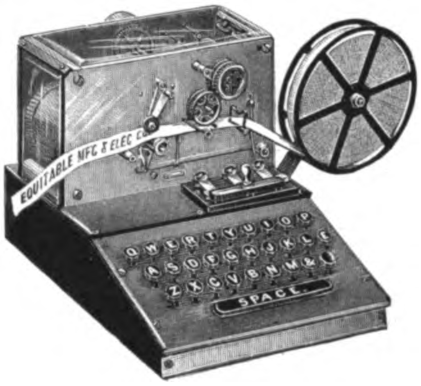
The Distribution of Power From Niagara Falls.

Several schemes of a considerable magnitude are on foot for the utilization of the electricity furnished by the Niagara Falls Power Company. It is reported that a syndicate capitalized for $4,000,000, has been formed for the construction of a line and the distribution of this power between Niagara Falls and Albany. It is also reported that a contract has been made with Rochester parties for supplying them with 25,000-horse power, or such a part of it as is required as soon as the line can be constructed, and that propositions have been made to capitalists in different cities in the eastern part of the state for the same purpose.

The Improved Printing Telegraph.

In the accompanying illustration is shown the latest improvement in the printing telegraph by which messages and communications are sent and received in plain type. It requires no skill to operate the instrument, being operated practically the same as a type-writer. For its use but one wire is required, and in this way it possesses many advantages.

The instrument is not large, may be easily carried from one place to another and connected to any temporary or permanent wire. It possesses many advantages for use in connection with the fire department or police system, and can be used on long or short lines. For use on railroad and isolated telegraph lines, and in many places which will not warrant the employment of a high class operator, it is well adapted. A large amount of current is not required, and any available source of electricity such as electric light current, gravity, carbon or storage batteries may be used. But one instrument is required for sending and receiving a message. The record is plainly printed in such a manner as to leave the least possible opportunity for error. The mechanism is simple and well made, all the parts being interchangeable, so that if broken by accident they may be quickly and easily replaced.

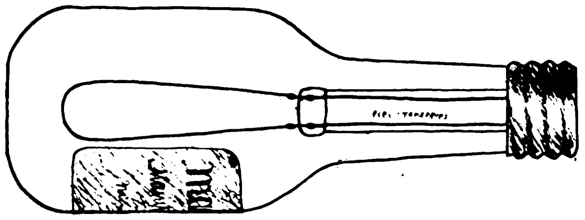


AN IMPROVED PRINTING TELEGRAPH.

These instruments are manufactured by the Equitable Manufacturing & Electric Company of New York City. The Enterprise Electric Company, 307 Dearborn St., Chicago, is the western agent and is putting a set on exhibition, in connection with its exhibit at the World's Fair.

A Novel Lamp.

Mr. E. Oscar Hart, agent of the Manitou Mineral Water Company, 35 Van Buren street, Chicago, has devised a very clever scheme for lighting his office and at the same time advertising his wares. He has designed and patented an incandescent lamp that is as near as circumstances will permit, a fac simile of the bottle in which Manitou water is kept. The glass is blown thin to decrease its weight and the filament is inserted through the neck or mouth of the bottle in the regular Edison receiver, the base being fastened on over the mouth.



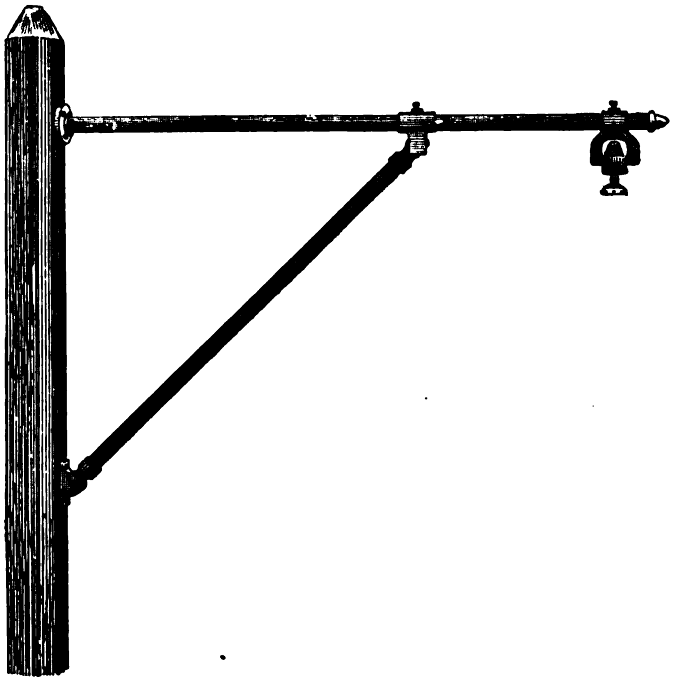
A NOVEL LAMP.

The bottle is about the size of the ordinary soda water bottle, and the filament is of about 32-candle power, both being made for Mr. Hart by the Edison Lamp Company, of Harrison, N. J. Proper labels on the side of the lamp advertise the Manitou Springs water.

It is claimed that the patent recently awarded Mr. Hart covers the shape and the combination of labels with the same for advertising purposes. He has a very fine exhibit in the Agricultural Building at the World's Columbian Exposition, in which he has used over a hundred of these lamps, and the effect is very fine. The development of the present form of lamp was by no means without trouble the earlier forms being made in the regular heavy glass bottles, the lamp itself being in the form of a cylinder, about one-half inch through by about six inches long. These bottles, as might have been expected, heated very badly, as well as being too heavy for the sockets to hold in any but a vertical position. Mr. Hart early saw the advantage of the use of electric lighting for advertising purposes, and he has certainly made use of it in a very neat manner.

New Adjustable Pole Bracket.

We illustrate a new adjustable pole bracket, manufactured by the Creaghead Engineering Company, Cincinnati. This bracket is made of one and a one-half inch pipe with special castings and fittings, and is designed for bracket line construction for suburban street railways or for center pole construction in crowded portions of cities.



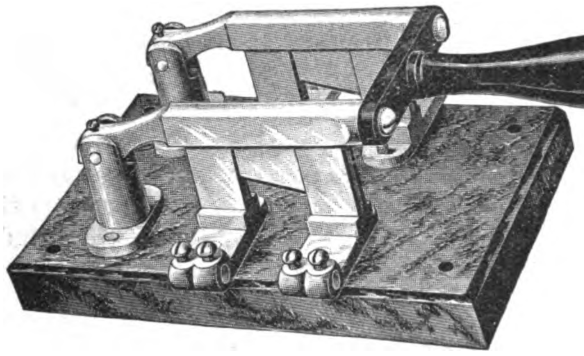
NEW ADJUSTABLE POLE BRACKET.

The manufacturers make special claims as to the stiffness of this bracket. The upper and lower ends of the brace, supporting the arm, are provided with hooks which engage in special castings. The use of these hooks makes a bracket that is very easily put together, as bolts are not required in either end of the brace. The bracket arm is made six feet long, or even longer if desired. A pole bracket insulator, made to fit one and one-half inch pipe, makes this bracket complete. The company reports that this bracket has commended itself to all practical street railway men, who have examined it, and they have already secured a number of orders.

New Double Pole Switch.

In the accompanying cut is shown a 50 ampere double knife switch manufactured by J. Grant High of 123 N. Third street, Philadelphia, Pa., who has had an extended experience with the manufacture of electrical goods.

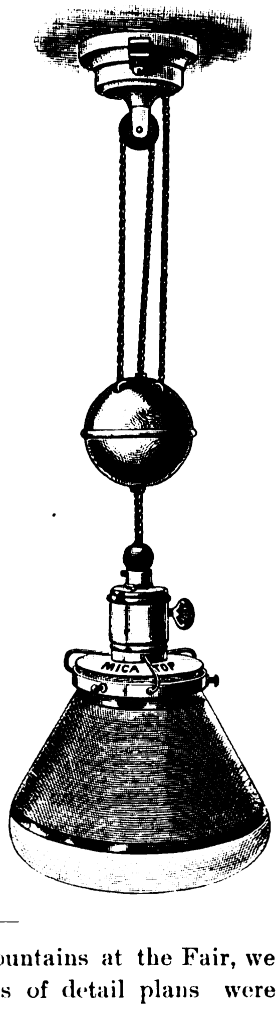
Special machinery has been put in for the manufacture of these switches and great care has been taken in their construction to make the switch as perfect in all its parts as possible. The switches are finished and fitted in the best manner and are mounted on either marbleized, enameled or plain slate as may be desired. To produce a switch that will have a quick break and is also close fitting, so that a good contact is made, has been the aim of the maker.



NEW DOUBLE POLE SWITCH.

Columbian Adjustable Hanger.

In the accompanying illustration is shown a hanger which will undoubtedly be greatly appreciated by users of electric lights. It is entirely different from the hangers so far placed on the market using springs, differential poles, ratchet catches, etc. It is exceedingly simple in construction, being a counter-balance so arranged that the weight is equally sustained by three cords, and so perfectly adjusted that there is no wear on the cord. All parts are so well constructed, the mechanism being very simple; there is nothing to get out of order. They are so complete that all that is necessary for the customer to do is to attach it to the ceiling, as is shown in the illustration. They are fitted with any kind of socket desired. A large number of these hangers have already been sold, and purchasers have been well pleased with them. This hanger is known as McCreary's specialty No. 22, and is manufactured by the McCreary Electrical Specialty Company, Electrical Exchange Bldg., New York. This company has been in the field for some time and its goods are well known.



In the article on the Electric Fountains at the Fair, we omitted to mention that the cuts of detail plans were reproduced from those in the Electrical Engineer and are official in every respect.

The Electric Heater.*

The increasing interest manifested in electric heating apparatus during the past year throughout the United States and Canada is highly satisfactory, and without a full knowledge of what interesting application of heating devices may have been made in the United States, I will endeavor in this paper to outline what we have accomplished here in Canada, and more particularly in the city of Ottawa.

The ideas relating to the limited field of electric heating are fast disappearing, and the notion that an electric light or railway plant, unless operated by water power, cannot profitably introduce electric heat, is but an instance of history repeating itself, as witness the introduction of the telephone, incandescent light, etc.

The operation of the electric heater may be compared to that of an incandescent lamp in which, as is well known, good conductors of electricity are carried to the terminals of the lamp filament, the latter purposely made a poor conductor, in order that the resistance offered by the filament, and overcome by the current, may produce a sufficiently high degree of heat to give the desired light. Although light alone is the object sought, it is but an accompaniment of the incandescence of the filament. In the electric heater, heat alone is desired, and heat alone is present.

The size and length of the lamp filament, and the wire of the heater are both determined in very much the same manner, excepting that in the case of the heater, the calculation for amount of wire does not subject the heating wire to such a degree of heat as in the case of the incandescent lamp. The size and length of wire employed in a serviceable electric heater should be such that the heat developed will not be sufficient to destroy it by oxidation or fusion.

I have concluded that iron wire is most desirable, and among many points in its favor is that its resistance increases with the heat. The benefit of this quality is felt when the electro-motive force is increased, as frequently happens for short intervals in nearly all classes of circuits.

By the method of construction, and the use of good non-conductors of heat, as insulation and packing, the heat developed in small water heaters and large water furnaces is directed to the copper vessels containing water around which the heating wire is wound; the heat is quickly transferred from the wire to the copper vessel which can never reach a very high degree of heat. The air draught in my other heater operates in very much the same manner as the presence of the water in the liquid heater.

It is an interesting fact that the good conductors of heat are also the good conductors of electricity, and the poor for one is also poor for the other.

I will now proceed to a brief description of some of the electric heating installations which have been in successful operation during the past winter.

In July of last year I had erected in the car shop of our local electric railway a baker's oven eight feet square, which was built of brick in the usual way, excepting that within the oven and set in the foundation were placed two of my 20-ampere, 50-volt cylindrical stoves, the interior of the oven being whitened and lighted with incandescent lamps, a small window looking into the oven and provided with three panes of plate glass separated from each other by air spaces, being provided for the purpose of observing the process of baking, cooking, etc. The oven was also equipped with a clock and a pyrometer, which latter instrument recorded the degree of heat within the oven. The pyrometer indicating 400 degrees Fahrenheit, a neighboring baker tried a few pans of buns. The process of baking was watched with much interest, and from the puffing up of the dough to the pretty brown finish could be seen through the window of the oven, which, as before stated, is provided with incandescent lamps. A short time after, a full dinner of one of our leading hotels was cooked, including a 21-pound roast of beef, several turkeys, ducks, lamb, etc. This electric dinner was served to the regular guests of the hotel, together with a distinguished company of invited guests. The cooking of the meats was pronounced perfect, and the time occupied in cooking was thirty minutes less than is usually required to do the same work in the hotel range.

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* Abstract of paper read before the Chicago Electric Club, May 22, 1893, by Mr. T. Ahearn.

As no long continued test of hot water house heating had been made, I concluded that only two installations of this description should be made during the winter just passed.

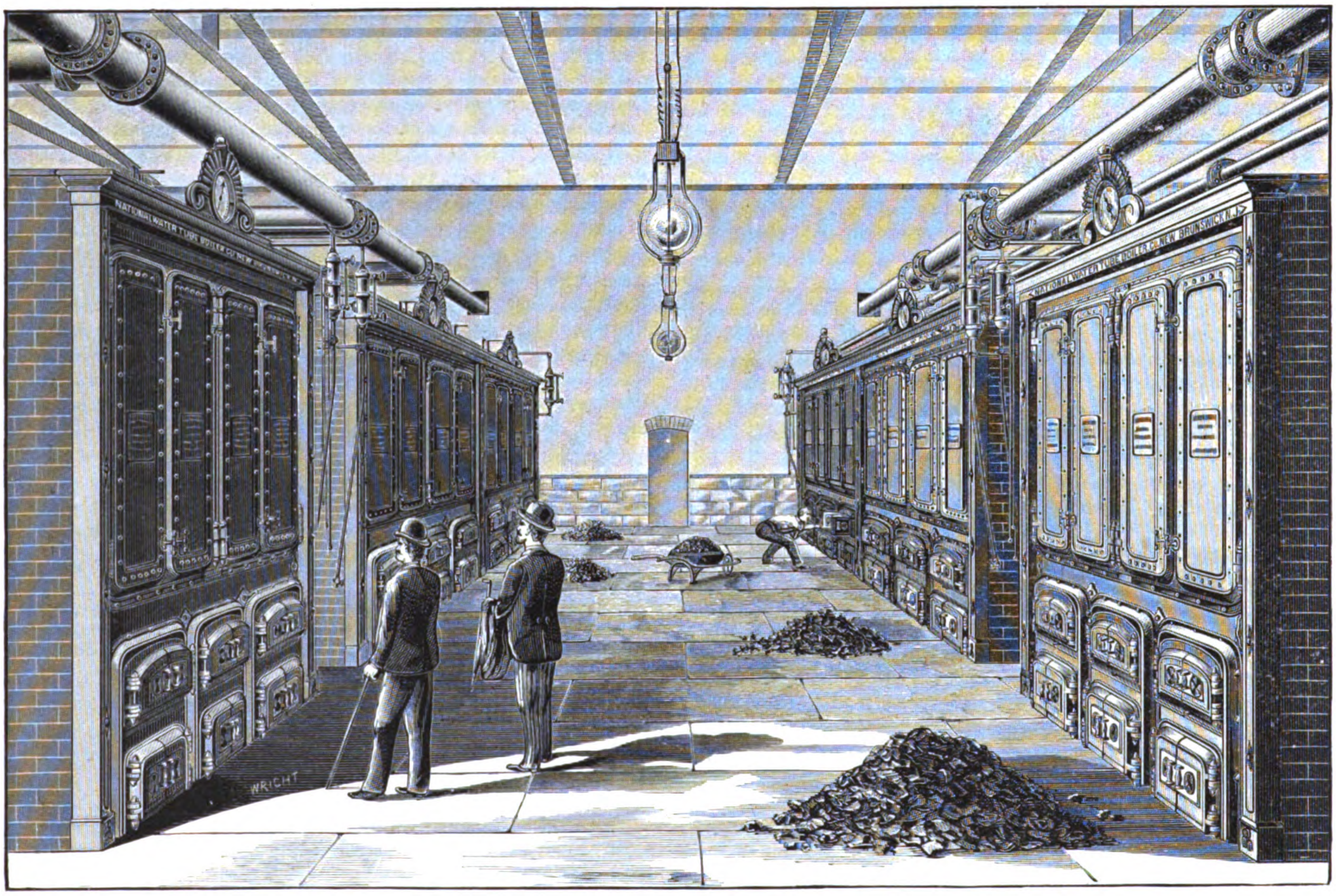
The first installation was made for the purpose of heating a gentleman's conservatory in this city. The furnace was placed in the basement, the controlling switches on the floor above, and all connected with the 50 volt lighting circuit. The total amount of pipe employed in the conservatory was 300 feet, the current absorbed being equal to three-horse power. The amount charged by the light company was based upon the cost of an equal amount of power from motor circuit. The operation of this plant has been a great success, having worked continuously and absolutely without attention since October last, the user being so much pleased with its success that the question of heating the entire premises electrically is now under consideration.

The second installation of the hot water system was made in R. A. McCormick's drug store, Sparks street, this city. The premises were piped throughout for hot water heating in November of last year, the electric furnace being placed in the basement. This 50-volt furnace was constructed in five independent heaters radially connected to a common supply pipe, each heater being independent of its neighbor, the five sections both mechanically and electrically being connected in multiple. Each of the sections was controlled by five 10-ampere switches which were placed in a row in the store above, so that for all conditions of weather the heat could be regulated by turning off and on any of the five sections into which the furnace was divided. Another important consideration which suggested this design, was that in the event of trouble with any of the five sections comprising the complete furnace, it could be detached by closing the valves, and the particular section which might require examination could be removed without disturbing the other four-fifths. Despite the fact the past winter was unusually severe in this usually cold climate, this outfit worked without a hitch, and without attention of any kind, and provided at all times the best heat desired.

The charge that is here made for current used in the numerous one gallon water heaters which have been largely introduced by the Chaudiere Electric Light Company, is based upon the amount charged for the 16-candle power lamp, which is $8 per annum (the user paying for lamp renewals.) Motor rates are charged for larger installations. These water heaters are used in barber shops, drug stores, bar rooms, etc., and absorb three times as much current as one 16-candle power lamp 3x8—$24. The company collects 50 cents per week for the current supplied each heater, making $26 per annum as against $24 if the same current was used for lighting. The charge is considered small by the users, and the service is very satisfactory.

A Compact Boiler Plant.

The boiler plant of the United States Electric Lighting Co. at Washington, D.C., recently constructed and put in by the National Water Tube Boiler Co., is shown in the accompanying illustration. These boilers were designed especially for this company and have many interesting features. The space they were to occupy is small, and special attention was given to designing a boiler which would occupy as little space as possible, and still have the required efficiency.



A COMPACT BOILER PLANT.

There are six boilers having a combined capacity of 2,500-horse power. The working pressure is 140 pounds, which can be raised considerably if desired without passing the safety point. Each of the boilers in this plant is entirely separate, having separate steam and water connections attached. Each boiler has three storage drums affording ample storage capacity for supplying any sudden or heavy demand for steam. The manufacturers have provided abundant openings for the cleaning or repair of the boilers and furnaces. Each furnace has three openings allowing one-third of the grate to be cleaned without disturbing the balance. In the sides of the boiler walls ample cleaning doors are provided, permitting access to any and all parts of the boiler. The larger door at the rear of each boiler setting furnishes an entrance to the rear of boiler and flues.

Annual Report of the Westinghouse Electric & Manufacturing Co.

On May 17th the board of directors of the Westinghouse Electric & Manufacturing Co. issued to the stockholders the following report:

Your Board presents herewith its financial statement for the year ending March 31, 1893.

It will be seen that there has been a profit from manufacturing of $1,491,817.13, and from other sources of $112,766.60, making a total for the year of $1,604,583.73. This is after charging to operating expenses the following amounts: $84,747.31 for alterations and additions to buildings; $155,484.87 for maintaining the machinery and tools in the highest order, and $58,188.86 for interest and discount.

The year began with large orders, but with only a moderate manufacturing capacity, and a proportionate stock of material on hand, so that the above earnings were made under unfavorable circumstances due to the fact that the capacity of the works and the material in stock and in process had to be more than doubled during a steadily increasing press of business.

During the year the company has manufactured and installed at the World's Fair in Chicago, an electric lighting and power plant, consisting of twelve generators of 15,000 lights capacity each—two of 4,000 lights capacity each, one 750-horse power generator, and several smaller ones. Six of the large generators are driven by engines having their shafts connected directly to those of the generators. This plant is the largest ever installed. These generators mark a new era in electric light and power distribution. They are of the "two-phase" type, designed to drive Tesla motors, and at the same time to operate both arc and incandescent lamps, thus making the one form of generator useful for three purposes. The total capacity of the plant exceeds the contract requirement sufficiently to meet the demands that may be made by exhibitors for extra lights. The company will also have at the Fair an extensive exhibit of its other forms of apparatus.

The stopper lamps now being manufactured in the company's Allegheny City works are being used exclusively in connection with the apparatus at the World's Fair. It is gratifying to be able to announce that in the manufacture of the Sawyer-Man stopper lamps, all of the advantages anticipated have been fully realized. The low cost of manufacture, and the high efficiency of these lamps, together with the ability to renew their carbon burners, enables the company to sell lamps at lower prices than can be afforded by any other manufacturer. To meet the demand a new factory has been equipped with special machinery designed for the purpose, and already has a daily capacity of 5,000 lamps, which is being rapidly increased, and will be shortly quadrupled. The expenses incident to the establishment of this new lamp factory have been charged to the business of the past year. This branch will hereafter add materially to the volume and profit of the company's business.

The success of the stopper lamp, its low cost of manufacture, and the fact that it is the discovery, prior to Edison's patents,of inventors whose patents belong to our company, have turned a temporary check into a great business advantage.

Our competitors have copied our plans and infringed many of our patents, notably those relating to power transmission, and many important details essential to the successful operation of alternating current apparatus for the distribution of electricity for light and power purposes, for which we have brought suits for infringement.

The confidence expressed in the last annual report, in the superior merit of the apparatus of the company, and in the strength and value of its patents, has been fully justified by the results of the year's operations; and we feel no apprehension as to the outcome of suits now pending or which may be brought by its competitors.

Your directors have been brought face to face with the fact that the business of the Company has outgrown the present capacity of its factories, and that large savings could be affected if the manufacture were carried on in new works equipped with the latest devices for handling its product by machinery.

In view of the favorable result of the past year's business,and of the volume of orders in hand, and the future outlook, your directors have not hesitated to accept a proposition from the **East Pittsburgh Improvement Company to sell to your company a site of 23 acres most favorably located with reference to railway facilities. The Improvement Company has agreed to erect on this site buildingsand works according to the plans and under the supervision of the officers of your company, and to sell them to the company at their actual cost, not, however, to exceed $500,000 above the price of the land, and have agreed to take pay therefor in quarterly payments of $25,000 and interest, beginning January 1, 1894. Your officers have estimated that the savings to be effected by the manufacture of its products in the new works, will, on a most conservative basis be more than double the amount of the quarterly payments. Thus, these new and complete works will be acquired without the expenditureof fresh capital, leaving the proceeds from the sale of the company's present property, as working capital, without taking into account the manifold business advantages that will arise from the centralization of its manufacturing operations.**

The results of the past year's business have shown that our apparatus can be sold for cash to responsible parties, and that the prevailing belief that long credits must be given, or that stocks and bonds must necessarily be taken in order to secure business, is not correct. Your officers and agents have found that low cash prices and good apparatus are sufficient inducements to secure all the trade the company can care for.

Although the profits of the business might have justified the payment of dividends on all of the stock of the company, the directors have thought it wise to pursue a very conservative policy, especially in view of the large expenditures required during the past year for machinery and material, and of similar expenditures which the present prosperous condition of the company's business may make necessary in the near future. Both the results and the prospects are so encouraging that the directors believe the stockholders will uphold them in a course which places the company in a position of undoubted financial strength, and which will assure the permanent continuance of dividends when once begun.

BALANCE SHEET MARCH 31, 1893.

ASSETS.

Cash in Banks	$212,573 85
Bills receivable	366,228 47
Accounts receivable	2,289,982 70
Materials in stock and in process of manufacture (at cost of labor and material)	1,414,662 31
Advances to leased companies	138,573 06
Bonds (par value $369,100)	358,197 15
Stocks (par value $6,469,257)	4,069,439 96
Real Estate and Buildings	453,037 98
Machinery and Tools	710,023 61
Miscellaneous	60,055 54
Charters, Franchises, Patents, etc	4,378,031 69
Total Assets	$14.450,806 32

LIABILITIES.

Accounts payable	$569,660 48
Bills payable, issued for merchandise	376,003 64
Discounted with collateral	931,884 51

CONTRACT AND CONTINGENT LIABILITIES.

Scrip dividend	194.562 00
Stock subscriptions	13,125 00
U. S. E. Ltg. Co.'s 6 per cent 15 year bonds, $50,000 payable annually	600,000 00
(Bills receivable under discount, $482,054 49.)	

CAPITAL STOCK.

Preferred, 73,378 shares	$3,668,940 50	
Assenting, 103,146 shares	5,157,331 00	
Common, 3,633 shares	181,650 00	
(In Treasury, 6,621 shares Preferred; 13,220 shares Assenting.)		9,007,921 50

SURPLUS.

Balance, March 31,1892		$1,880,445 20	
Twelve months net earnings from business	$1,491.817 13		
From other sources	112,766 60	1,604.583 73	
		$3,485,028 93	
Less amount written off in adjustment of matters pending in 1890 & 1801.	$321,228 05		
Ditto in current year	98,869 65	$420,097 70	
		$3,064,931.23	
Interest on Bonds	$39,000 00		
Interest on Scrip	11,973 72		
Dividends	256,603 32	307,282 04	
			2,757,649 19
			$14,450.806 32

Electric Heating.*

BY S. B. JENKINS.

The extensive use of heat, in the economy and comfort of daily life, is seldom observed; and the expense of, and labor incidental to the varied applications, still less frequently estimated.

The importance of heat is readily perceived upon reflection, but the exact estimation of its cost is a matter of considerable difficulty in common practice.

There are three distinct and available agents for the generation of heat for domestic and industrial purposes, viz.: Coal, Gas and Electricity.

It has been stated by Tyndall that he was able to obtain from the combustion of coal in the best range, a useful effect of 6 per cent and that the average of domestic practice was 3 per cent.

The combustion of gas gives a considerable higher efficiency, but its use is not at all commensurate with coal.

In the generation of heat from electricity, an efficiency in the production of useful effect is realized vastly greater than either and with which they can never possibly compete.

The perfection of conversion, the unvarying quality, the ease of precise estimation, and the ability to absolutely localize and control the exhibition of the heat of electricity, are unique and decisive points of superiority.

It is the present purpose to state what has been accomplished in the generation of heat from electricity, and its application to the production of useful effects, as exemplified by the apparatus of the American Electric Heating Corporation of Boston.

Ethically the rheostat is an electric heater, and has been the inspiration of many inventions in electric heating, but the invention of numerous electric heaters, as such, has resulted in their being set apart as a distinct type of electrical apparatus. While the fundamental principle of this conversion was understood, the early apparatus for the conversion, exhibition, and utilization of the heat, in the production of useful effect, was crude and inefficient; the idea seeming to prevail that it was only necessary to pass the current through a resistance, and the full effect must be realized, the intimately involved principles of radiation, conduction, and convection having apparently been omitted from consideration.

However, like this noble city of which it has been said, "A man who has never seen it may hear the Chicago man's description of it, and by the time he can get to see it, it is all true"; so the electric heater has advanced, through the labor of intelligent inventors, until it to-day meets fully all reasonable demands, and is a commercial entity.

The first United States invention of record in this field was made by G. B. Simpson in 1859. The earliest authentic electric heating in this country, so far as can be ascertained, was that done by Prof. Moses G. Garmer, who states that he heated his house, in the year 1867, with an electric heater on the lines of a rheostat.

Some less noteworthy and abortive attempts were made later by others, but it is only within five years that systematic attempts have been made to put electric heating on a commercial basis with any degree of success. This delay is the fault of neither the inventor the capitalist, nor the electric heater, but is the result of conditions; for obviously, when produced from batteries, electrical energy was too expensive to be used in the very limited quantities called for by electric lighting, and entirely prohibitive as regards its use for heating; not, however, on account of any inefficiency in the conversion into heat, for the incandescent lamp of today has an efficiency of 5 per cent, with a loss of 95 per cent, and in the electric heater these figures are practically reversed.

The introduction of the dynamo, with the consequent increase of the volume of current and decrease of cost, gave a powerful impetus; first to lighting, then, as station capacities increased, to the distribution of energy to motors, and finally, heating.

Owners and managers of generating plants perceive that, if electric lighting and heating are on a similar basis, the output is from forty to sixty times as much for heating as for lighting; and that the load line, when the energy is furnished to lights, motors and heaters, will be much more uniform.

The heating of churches on Sunday would come when the lighting and motor load was very small.

It remains to determine the commercial status of electric heating, which includes its operative advantage and cost.

The production of large volumes of electrical energy from water power has resulted in a demand for the electric heater in utilization thereof. A number of proposals have been received, from established power plants, to furnish energy at a definite price under definite conditions; such were the price and conditions, that electric heating was much cheaper than any other method, and in every way beyond competition.

It requires some time to assimilate the idea of running two large generators for sixteen consecutive hours to heat one building simply, for the turning on of electric lights in that building would be merely an incident and would not appreciably increase the load; this, however, is precisely where we are today when water power in abundance is within ten or more miles.

"To return to our mutton"—in the design of apparatus by this corporation, the "personal equation" is sought to be eliminated, and it will be observed that in very few instances is there any provision made for the regulation of the temperature by the operator other than by opening and closing the switch in circuit; it having been found that a predetermined temperature, selected with reference to the best and broadest practice, and after extended practical test, conduced to better average results than when the temperature was controlled by workman or domestic, and that when regulation was provided it was not used.

In many of the small articles, such as smoothing irons and cooking utensils, any arrangement for varying the heat involves useless complications, or, on the direct circuits, the wasteful generation of heat in an external resistance.

It is sought to produce heat only when needed, and to apply it only and exactly where its useful effect would be greatest. This is the secret of the present success of electric heating.

Ovens, the service hot water boiler, and some other continuously operated apparatus are constructed so that the temperature can be varied within wide limits, without the use of an exterior resistance.

In heating houses, offices, and buildings generally, the heat may be made exactly proportional to the necessities, and admit of wide variation at pleasure.

One large city house, that has been heated since the fall of last year, has a large primary heater in the cold air duct where the displaced hot-air furnace stood, and just below where the feeder pipes branch off to the risers; this heater is controlled by a switch close by.

Just within the register openings to the rooms above are located smaller "reheaters," each controlled by a switch in the apartment. In the early fall or late spring, when a gentle heat only is desired, the large primary heater is run; when more heat is necessary, the "reheaters" are turned on. Should heat be required in moderate weather, in only one apartment, it is instantly at hand without affecting other rooms.

Sectional radiators are constructed of the same general design as steam apparatus, together with stoves and portable heaters of every desirable size and style; and the first cost of this heating apparatus is in general terms not more, and often less, than ordinary apparatus doing similar work in a much inferior manner; for there is no odor, dust or gas, no coal pile, no ash-sifting, no attendance of account, but there is absolute control, and knowledge of exact cost.

A complete equipment for the kitchen, laundry, and butler's pantry is provided, with which all the domestic operations may be conducted with perfect certainty and cleanliness, in less time and with half the labor incidental to old methods.

Beef is roasted at the rate of seven to seven and one-half minutes to the pound, and the quality of the work is only excelled by the ease of its performance. The heat, which is largely radient, and of great intensity, is produced evenly all around the oven, the effect being so perfectly uniform that it is not necessary to baste the meat, or to turn the bread or cake while cooking.

Broiling is difficult under ordinary circumstances, as an intense, clear fire is required, and care must be used to avoid smoking the meat, as that gives it a bitter flavor; the electric broiler meets all requisitions perfectly and easily, and steaks and chops are cooked in the usual time to the delight of connoisseurs.

Tea and coffee pots, of all styles, making the decoction from "the cold" in from six to ten minutes, of perfect quality, steam cookers, stew pans, spiders, etc., are provided to meet all demands.

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*Read before the Chicago Electric Club, May 22, 1893.

The domestic supply of hot water is furnished from the electrically heated copper service tank, or a heater attached thereto.

The first cost of this equipment is about the same as that of the ordinary outfit.

As the laundry irons are not set on a stove, they may be kept perfectly clean. The heat is an effective so-called "live heat," without the attendant discomfort in a hot day of a highly heated stove.

A variety of apparatus for industrial use is shown, such as soldering irons, devices for brazing and soldering, electrically-heated muffles, and smoothing irons for tailors', dressmakers', and hatters' use. These are all simple, easily operated, and partake of the general advantages, and have individual features of excellence. Electric tram-cars are heated equably and comfortably without difficulty.

All apparatus is constructed for operation on either direct, or alternating circuits, having a potential of from 25 to 118 volts, with the exception of that for heating air, the car heater operting at 400 to 500 volts, and the heating apparatus for buildings, at 104 to 236 volts.

Having noted the salient features of the apparatus, a detailed description of some practical tests will be of interest.

A hot water reservoir constructed of copper, tinned on the inside, nickeled on the outside, and having a contents of 23 pounds of water at 60 Fahrenheit, without jacketing, and having an electrically heated bottom forming an integral part of the vessel, had placed in it 16 pounds of water from the service tap, at a temperature of 57 Fahrenheit. This was raised to 128 Fahrenheit in 20 minutes, or an effect was produced of 1136 lb. deg. Fah., with an expenditure of electrical energy amounting to 0.326 H P. H. which, at the contract price for power when and where this test was made, of five cents per H P.H., costs $0.0163 and the lb. deg. Fah. costs $0.00001434.

The cost of boiling one gallon from 40 Fahrenheit does not exceed two cents, by actual test, at this rate for energy. Some 500 heat units are expended in heating the vessel, and in radiation so that the actual cost of the unit is in round numbers one one-thousandths of one cent.

In the oven, 10 pounds of beef have been roasted, two loaves of bread baked, and 12 plates heated for serving, all in 90 minutes, "from the cold," with an expenditure of energy amounting to 1.5 H.P.H. or 1119 Watt-hours; this at five cents per H.P. H. is 7½ cents; or at 10 cents per H.P. H. is 15 cents. At the five cent rate this oven costs about two and one third cents per hour the first expense of "heating up" being gradually eliminated with each hour of continued service. Chops are cooked for one cent, an oyster stew made for half a cent, tea and coffee for four-tenths of a cent, all in sufficient quantities for the ordinary table, the energy rate being five cents per H.P.H.

Large electric cars are heated to 60 Fah., under all weather conditions, with an average consumption of energy of 1,000 Watt per hour, in the climate of Boston. This should be very satisfactory, though no exact figures of expense can be given, as the cost of power on electric railways is not stated. It is fair to assume that it costs not more than 40 cents per car per day of 18 hours. When electric cars are heated, they undoubtedly divert to themselves sufficient carriage patronage to pay for the heating.

The average well-built city house in a block requires an equipment for heating, on the basis of an expenditure of electrical energy of one H.P. per 1,200 cubic feet of space, though this amount is by no means required to be used continuously, and is stated as a maximum. It is impossible to give any exact figures unless for a particular instance when all the conditions are precisely stated. Steam heating engineers with long experience and voluminous data are accustomed to calculate the individual requirements, and only then will they guarantee results.

The ultimate large development of electric heating necessitates the production of vastly greater amounts of electrical energy than have heretofore been considered necessary; and it will be a growth, steady and sure, culminating, in less time than electric lighting has been before the public as a commercial entity, in a great industry, second only to the supplying of food.

It is now being adopted by many who are conversant with its advantages, who can at once replace the old contrivances with the new, and must very shortly be adopted by the many who, doing a part of the labor incidental to the household, seek to do it as easily, cleanly and economically as possible, and by those who consider the welfare of dependents and that observance of economy, which is both wise and honorable.

It was, in times past, faucet *vs.* pump; it is now switch *vs.* coal-hod, and the triumph of the switch is unquestionably at hand, for the introduction of electric heating into houses, offices, hotels, hospitals, and theatres is being accomplished on a purely commercial basis.

Tyndall's estimates being accepted, that 6 per cent or 780 heat units of the 13,000 in one pound of coal were utilized as a maximum, and assuming that 800 are now utilized, then 2,000 lbs. of coal produces in useful effect 1,600,000 heat units.

A horse-power year is assumed to be 4,000 hours out of 8,760 which the year contains.

In round numbers, electricity at $0.15 per H. P. H. or $60.00 per H. P. year of 4,000 hours (which is eleven hours per diem on an average) is equivalent in practical useful heating effect to coal at $6.00 per ton, and the coal must be hard coal of best quality, burned with good ordinary care and discretion. This is on the basis of a contract for power as follows: viz, Consumer of power agrees to pay $60 00 per Horse Power per year, using it whenever he chooses—all the time if he desires—perhaps 8,760 hours; but the average use of the householder under average circumstances, would be 4,000 hours only—or eleven hours per diem throughout the year, except in sections of the United States, south of Mason and Dixon line, where it would average about 3,000 hours only.

It should be observed that electrical energy can never be adulterated: that exactly the amount used is paid for, if attention is given to the measurement. It is easily possible to measure electricity with greater precision than any other commodity, and to calculate the expense of any work done to the thousandth of a mill, if desired.

The preceding estimate is for the heating of houses only; the cooking is on a different basis entirely, as electricity at five cents per H.P.H. will compete directly with coal at $5.50 per ton of 2,000 pounds.

Electric Heating.*

BY CARL K MACFADDEN.

The fact that an electric current when passing through a resisting conductor will generate heat, has been known for years. During the past thirty years it has been applied to an ever increasing extent in the manufacture of heating devices used in almost an unlimited number of ways. It remained, however, for the electric street railway to open up the field for heating. The fact that there has been issued during the past two years and a half over eighty per cent of the total number of patents on heating devices, shows conclusively that the influences which have made themselves felt during the past few years in the general development of electrical apparatus has not left heating behind in the list of improvement.

The first patents issued on electric heaters were taken out in the fifties, and a few years later several were taken out on an oil well heater for melting paraffine and other obstructing material from the bore of oil wells.

There are to-day in the neighborhood of 150 patents on electric heaters, which alone goes to show that considerable attention has been paid them by the inventors. A very large number of these patents apply to the heating of cars. One of the earliest applications for patents on electric heating apparatus, filed in 1869 by Burton, specifies that one of the largest applications of this particular heater for which patent is applied, is that of "heating railway carriages by means of heated metallic plates placed under the feet of passengers." Among the many patents issued will be found some that would seem extremely impractical.

To one who has not investigated the remarkable differences in the carrying capacity of a wire when provided with various means of radiating its heat, it will appear astonishing to see a wire carrying safely several times the current that would fuse it in open air. The principle of all wellknown heaters is that of placing a good heat conductor, having a large radiating surface, in intimate contact with the electric heating conductor;

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*Abstract of paper read before the Chicago Electric Club May 22d. 1893.

and there is little doubt that, inasmuch as nearly all serviceable heaters depend upon this principle, the advantages of one make over another will be more in the line of mechanical details in construction than in efficiency. If the heater is made unusually heavy and contains a large amount of heat-conducting material, it will reach its final maximum temperature much slower than one that is built with its heat conductor or reservoir of lighter and thinner material. It may appear immediately after starting both heaters that the latter is more efficient, but if the amount of energy taken up and the radiating surface is the same in both, it will be found that although the heavier heater heats much more slowly than the lighter one, it will hold its heat and remain in a highly heated condition for a longer time after the current is turned off than the lighter heater.

As before mentioned, the electric railway opened up the field for electric heating. The first Sprague road in Richmond, Virginia, was equipped with electric heaters. It has been shown many times that the cost of operating electric heaters on electric roads stands on a par with coal when consideration is made for the value of space that the coal stove generally takes. The electric heaters are generally placed in four or more places in the car where they will be out of the way of passengers when seated, and in such a position that they will at the same time throw their heat into the body of the car. There has been considerable discussion in regard to the amount of current necessary to keep a car warm in cold weather. Reports from roads operating in Northern Michigan and in other portions of the United States and Canada, where the winters are unusually cold, show that from 1,200 to 1,500 watts is sufficient current to keep the average sixteen foot car warm in all kinds of weather. It will be seen that inasmuch as the heaters require no attention whatever, and are practically a fixture of the car, that the cost of maintaining and operating on the average electric road will be simply the cost of current. Coal stoves take from twenty to forty cents per day to operate if the least account is taken of time used to keep them in heating condition. The coal stove also takes up room for one or more passengers while it remains in the car, which, on a road doing a good business, is a very important item. Coal stoves, too, on cold days, when being heated unusually warm, become so hot that it is often impossible to stand immediately in front of the stove without burning the clothing of the person standing near.

The electric heaters, being placed under the seats out of the way, and furnishing a lower temperature, cannot be objected to on this score, and being entirely out of the way of passengers, and taking up no space in the car which can be utilized to bring in dividend, often saves in a day more than the entire cost of the current furnished them for the day's run.

If we assume that the only cost of running electric heaters is that of the extra amount of coal burned at the power house, there is no opportunity for argument as to the cheaper method of heating electric railway cars, even when not taking into consideration the convenience and gain in car space by the use of electric heaters, but if the engineer's time has to be figured in for additional attention to engines and dynamos for current for electric heaters, why not figure in a portion of the conductor's time who oftentimes is called on to take care of his stove while on the run, even though a man be stationed at the terminal point whose special business is to oversee the heating?

The total cost of one net horse power at the engine on a plant with an average output of 500 electrical horse power is about six-tenths of a cent per hour. The cost of an electrical horse power hour will be found in this same plant to be about one cent. It will be seen from these figures that the total cost of operating electric heaters will be in the neighborhood of two cents per hour.

I believe that it is just as fair to both sides of the question to assume that the fireman and engineer will not be called on for near as much additional work to furnish current for electric heaters as the street car conductor and other helpers whose time is wholly or partly taken up in attending to coal stoves. I assume that electric heaters on these cars could without doubt lower the cost of heating. Under these conditions, as they now stand on this road, the cost of heating during the past winter was far less than in the preceding winter. In many instances coal has to be carried from the power station, or some other point, to the terminus of the line where the cars lay over before starting on their trips. This hauling should be taken in as item of expense connected with the use of coal stoves.

In a great many estimates which have been made in regard to the cost of coal stoves on electric roads, items have been left out which, when added to the cost of the coal, will bring the actual cost of heating a car on a cold winter day at about the figures to heat the same car by means of electricity. The average life of a street car stove is about three years, and the repairs on even the best make of stoves will be found to amount to a considerable sum before the stove is ready to be abandoned. It also takes time to put these stoves in position, and to remove them at the end of the season. A finely upholstered car soon starts the foundation for an upholsterer's bill, which, of course, on a road equipped with electric heaters, should be a small item of expense.

It is by no means an unheard of thing for a coal stove to set barns or cars on fire; a thing which with a properly installed electric heater would be impossible to occur. When properly installed they cannot possibly injure wood-work in the car by excessive heat. There are few street railway companies using stoves for heating that do not find the cost of extra finishing and painting each year, caused by scorched varnish and woodwork around the stovepipe, as it leaves the car, to be such as to make quite an additional item to the maintenance of car bodies.

Where power is cheap and coal is dear, which is a condition often met with in mountainous districts supplied with water power, electricity will necesarily play quite a part in heating.

A Pelton water wheel, when running under a large head of water, such as is met with in the Western mountainous districts, can be harnessed to a little mountain stream and develop enough current to heat and furnish power for a small factory with practically no cost except attendance and depreciation on cost of machinery.

Under such conditions as these electricity could be used to great advantage for heating purposes, even quite a distance from the generating station. There are other places in the West where power is guaranteed the year round at $10 per horse power from turbines. These figures may, of course, be exceptionally low as compared with water power in the Eastern states, and, at the same time, I might say that there are many places in the West where even $10 per horse power would be considered a high figure. Power being obtained the year round at $6 to $9 per horse power, delivered at the turbine. Many mines in the West are equipped with large water power, and could use electric heating to great advantage in keeping certain exposed portions of the power plant at a comfortable temperature.

The use of electricity in the kitchen reduces the art of cooking to a science. It is an easy matter to determine just how many minutes it will take to cook a certain dish with a current of a certain predetermined strength. This method leaves nothing to be guessed at, and of course, the current may be cut off and all expense stopped the instant that the cooking is completed.

There are, of course, a vast number of plants throughout the country that will not furnish current at a rate which would allow electric cooking apparatus to be used, provided it was simply a question of coal costing so many cents per hour and electricity a few cents more. There are advantages in the use of electricity for both heating and cooking which must not be ignored. There are a great many places where electric light costs more than gas and still it is the modern illuminant. It has advantages which gas has not, and the public is not slow to take advantage of them; and for this reason more than any other there are few towns of any size that do not have their electric lighting plant, even though a gas plant has already been installed.

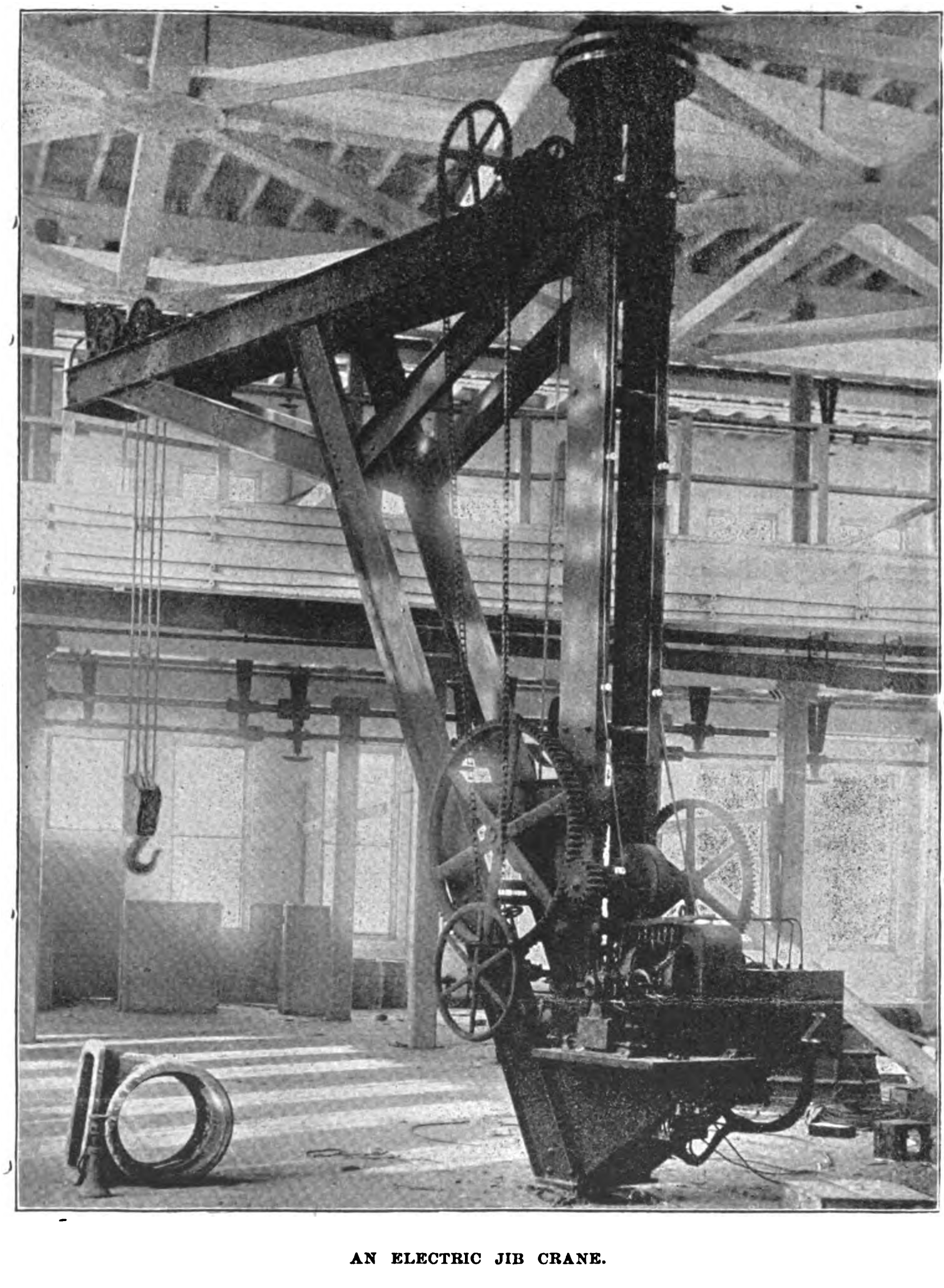
For the heating of chemicals and other applications where an exact amount of heat is needed, electricity possesses more advantages than any other method of heating, and there is no doubt but that in this particular line electricity will be used to a large extent.

In conclusion I would say that the field for electric heating seems to be on the eve of development in a sense that will be a surprise to even those laboring in this branch of work.

An Electric Jib Crane.

The Detroit Foundry Equipment Company has recently erected in the Michigan Brass and Iron Works, Detroit, two jib cranes, one of five and the other of ten tons capacity of the pattern shown in the accompanying illustration.

The cranes are equipped with electric motors especially designed for the work. They are slow speed and reversible, and of respectively ten and 15-horse power capacity. An operator can easily control the movements of the load from the motor, regulating the speed, stopping and starting, etc. The motors were built by the Detroit Electrical works.



AN ELECTRIC JIB CRANE.

A hand wheel is provided for racking and the crane is also fitted for operating by hand in case of accident to the motor. A wire cable is used for hoisting. These cranes were made and erected by the Detroit Foundry Equipment Company of Detroit, which has had an extensive experience in foundry equipment.

Electric Stations as Insurance Risks.

In an extended and valuable paper read before the Fire Underwriters association of the Pacific at San Francisco, Cal., Geo. P. Low says:

We are all too familiar with the makeshift construction of the buildings that contained these original stations. In many cases the buildings were put up with absolutely no regard for fire risks. In them were placed valuable plants consisting of steam and electric machinery. Boilers and engines, with their fire boxes, flues, piles of fuel, steam pipes, oil and greasy waste, constitute a fire hazard necessitating on the one hand the exercising of no little skill in its operation; dynamos with their accessory appliances and wiring, all laden with a new and most potent form of energy, the hazards of which were unheard of and unknown. Then again, as defined in our typical station, the projectors of these early stations were all venturing in an untrodden territory. They did not know the fate their enterprise would meet. They simply advanced upon belief, and under such a condition it is natural that every unnecessary expenditure should have been avoided. Everything was temporary and as cheap as possible; apparently no one knew how to erect a station on any other plan, or at least no one had done so.

In adjusting losses on electric stations fire underwriters were many times imposed upon and swindled by station managers who insisted that the dynamos which had gone through the fire were total losses, whereas they knew that the losses were but partial ones. Time after time the losses have been paid on dynamos and other electric appliances which were damaged to one-quarter or one-half their actual value. The fire underwriters, innocent of the frauds successfully practiced upon them, paid the losses, but they carefully wrote down in their little books the lessons learned to the effect that dynamos and all electrical appliances are easily damaged both by fire and water; that losses on them were almost invariably total, and that therefore they present unusual hazards which must be charged for in rating electric stations. In view of these facts, no one can charge the underwriters with bias in levying the rates that have been fixed upon the class of electric stations under consideration. Perfectly clear is the further fact that certain unprincipled electric concerns are largely responsible for the adverse opinions underwriters hold regarding electric stations.

On the Pacific coast the losses due to electric stations has been limited, but experience concerning any class of risk are contagious, and the direful lessons learned by eastern underwriters have created a feeling of uneasiness in this line on the coast. As it is, probably one-half of the companies refuse to write on electric stations, no matter what the merits may be. The wisdom of making the prohibition absolute may, I think, well be questioned, for certainly few manufacturing plants contain less material of a combustible nature than the modern fireproof central station. The textile mills have their cotton, woolen and lint goods, grist mills have their feed, grain and explosive dusts, wood working industries have their piles of sawdust and shavings, but the modern electricity factory, with its thoroughly fireproof construction, its steam plant, dynamos, its switchboard and accessory instruments, is absolutely incapable of supporting combustion, for the iron and steel plant, the iron and copper of the electric machinery, the marble and slate of the switchboard, which within brick or stone walls, with iron roof and with concrete floors, constitute a modern electric station; these will not burn. The product of its whirling armatures, unlike the products of clashing loops, or grinding rollers or roaring planers, does not remain in a constant menace to the premises. Instead, its product in the form of hundreds or thousands of horse-power of marketable electric energy is unseen and unheard The laws for controlling it, being now fully understood, are fully carried out, and in the modern station the occurence of the fire is impossible. Indicate if you will a more desirable risk.

Reverting to the destructibility of dynamos by fire and water, it is well to impress at the outset the futility of any endeavor to lay down general ideas that will apply to all machines. A specific knowledge of the form and make and capacity, and even the date of each machine is almost invariably necessary in order to derive the amount of injury which it has received. To illustrate it is almost always necessary to rewind the armatures of dynamos that have been burned. If the shaft is not sprung, it is safe to say the armature when unwound will be about as good as new if the machine is of recent type; if not it will be all right when rewound, or it may be worthless according to whether or not the laminated armature disks are insulated from each other by rust or by paper. The massive field castings or forgings if not cracked or warped are not susceptible of material injury from fire, and frequently the only injury suffered by field coils is repaired by rewinding a few outer layers. The cost of the ordinary cast iron castings of a dynamo does not amount to a great deal, as by reason of perfected machinery the labor of finishing them is reduced to a minimum, hence their value, to a large extent, the value of the iron, plus the freight. This being the case, dynamos builders do not care to take such castings in part payment for new machines, nor is it always profitable to purchase new parts to replace those destroyed for the reason that the prices of separate parts of dynamos are considerably higher than the same items would appear in the aggregate price when shipped as a complete machine. It is clear then that the cost of a "resurrected" dynamo might exceed that of a new machine, particularly if it is attempted to build it up from the fundamental forgings with new parts. Where duplicate parts may be made on the spot without sending to the factory, then the cost of the constructed machine, even if badly burned, will generally be considerably below its first cost. Particularly is this true of the latest forms multipolar dynamos, which are sold at the same basis as the older form of machine, that is, according to their lamp capacity. But the multipolar generators are of far simpler construction, there is far less labor in their making, and they are considerably more efficient; but despite these conditions, which all cheapen the cost of construction, the cost of the machine is estimated on the old basis, and what may be called the royalty profits are correspondingly increased. If a fire all but ruins one of these machines, it may be practically rebuilt at perhaps half of its original cost, and this may be done without the interference of the present company, as the reconstruction would be considered as repairs to a dynamo already sold.

Reverting again to the destructibility of dynamos, a water damage, even if it it be to a high potential machine, does not always necessitate its rewinding, and generally all that is necessary to restore it to its original worth is to dry it out thoroughly by baking. In some instances, however, the practicability of drying out depends upon the variety of machine. Some machines would have to be entirely rebuilt, others will be repaired by simply rewinding, but generally a thorough baking will prove sufficient.

Coming now to generating stations, it has been pointed out in previous papers read before this association that the electric wiring of such power houses is far more simple than that of any other electric station, and that, therefore, they are subject of a smaller hazard from artificial electricity than either arc or incandescent lighting stations. Both railway power-houses and incandescent stations are, however, more liable to damage by lighting than are arc lighting stations. The reason why this is so may be understood by comparing the action of a lightning stroke coming into the station over the outside line wires to the action of a hydraulic ram. Arc lighting dynamos are series wound, that is, the entire output of their armature goes through the field coils and then to line; street railway and incandescent generators are shunt wound, that is, only the small part of the output of their armatures is shunted or diverted off through field coils. When lightning enters an arc station, therefore, it follows the line wire and circuits around the field coils, which does not occur in shunt-wound machines. Now a current of electricity that suddenly rushes into many turns of wire coiled about an iron core reacts upon its self in an action called induction, which, though not exactly so may be considered as nearly identical with a kickback of a hydraulic ram. An unusual pressure is thus thrown upon the line, and the lightning takes the short cut to earth afforded through the lightning arrester and is satisfied. The damage to dynamos usually attributed to lightning is not really due to lightning itself, but to the fact that the terrific potential of lightning breaks down the insulation of the machine, when the dynamo destroys itself by its own currents. Underwriters are generally exempted from loss on dynamos caused by lightning or "natural" currents, but should the burning of an armature by lightning cause a station fire, then there should be no exemption from loss on the station. Protection from lightning is therefore entitled to full consideration, and it is almost safe to assert that a thorough modern station can be made lightning-proof.

Mr. Low here presented communications and statistics from a large number of stations on the Pacific coast, from which he draws the following conclusions:

From the communications given will be noted two important conditions: First, that electrical people, in erecting new stations, are exerting great effort to make such stations absolutely fire-proof in order to avoid carrying insurance; and, second, that general dissatisfaction exists over the insertion of the co-insurance clause in policies. I cannot but feel that the dissatisfaction now existing between electric and insurance interests in reference to rates of insurance on the risk known as the modern electric station, is due equally to errors committed by each of the two interests concerned. It is not to be questioned but that the old form of electric station is deserving of high rates. The underwriters' position in this regard is impregnable, but where he has committed his error, is in failing to recognize by reduced rates new departures in station construction, which have unquestionably increased the safety of the plant. The underwriter is slow to forget his losses on electric light plants, and these were so severe that he fails to realize that there are electric stations and electric stations. This has led electric interests to erect their stations so as to be as near fire proof as possible, with the idea of carrying their own insurance. Electricians should bear in mind, however, that nothing is absolutely fire proof, and that no ordinary business can afford to carry its own fire risk.

On the other hand electrical people are quite in error in the contention that co-insurance is an unreasonable exaction, and that, to express their ideas plainly, it is a means of extortion. Such views are entirely wrong, and certainly equity in levying rates can be attained only through the plan of co-insurance. To describe the details of its workings is not within the scope of this paper, particularly in view of the fact that pamphlets describing it more fully than I am capable of doing are issued by insurance organizations. This much may be stated, and that is, only by co-insurance can perfect equity be attained. The plan is practiced exclusively in all marine underwriting, and in many European countries, and it is in recognition of the dissatisfaction which is prevalent in electric stations that underwriters are making recourse of the plan of co-insurance for a solution of the difficulty.

The existing situation between insurance and electric interests may be summed up as follows: the electrical fraternity, forgetful of the injury it has inflicted upon underwriters, is thoroughly dissatisfied with the present rates and methods of insurance procedure, and is devoting every energy to eliminate the hazards of the business with the idea of carrying its own insurance. On the other hand the underwriters, smarting under the losses they have born, fail to recognize the improvements that have been made in electrical construction. This you must do, or some day it will transpire that electric stations have placed themselves generally beyond the necessity of insurance. Whether the idea is tenable or not, it is the one now held by electrical people the country over, and as such demands your consideration.

WORLD'S FAIR NOTES.

The work of installation has been hurriedly pushed during the last month, and is now about complete. The exhibits in the electricity building are probably as far behind as any, but show evidence of being all completed at once. The Government building was, much to the surprise of the majority of people, the first to complete its exhibit, and the show in that building certainly does credit to the country and its officials.

The French exhibit in the Electricity building is progressing very slowly; only a few of the displays of the different business houses being yet unpacked. It promises, however, to be very elaborate when completed. The exhibit of electric pianos in the northwest corner of the gallery will doubtless attract considerable attention as the instruments are first-class in every respect.

The German section advances slowly but is nearly completed as we go to press. Like those in the other departments the German exhibit in the Electricity building promises to be one of the finest installed. The managers are spending time and are taking pains to have it in every way complete when it is opened for inspection.

The booths in newspaper row are gradually being occupied, the rails having been completed during the last two weeks; carpets are mostly down, desks and chairs placed; the whole row begins to take on an aspect of business.

The offices of the secretary of the American Institute of Electrical Engineers are finished and furnished ready for occupancy. They only await the arrival of Mr. Hammer to decorate them with pictures, and other matter that he has been collecting, to put them in order for Mr. Pope, who will probably take possession about June 10th.

C. J. Hirlimann, of 19 Laight St., New York, is making a display of the "C. J. H." primary batteries, in the southwest corner of the gallery of Electricity building. It is complete in all its details.

The India Rubber Comb Company and Goodyear Hard Rubber Company have an exhibit of hard rubber in different forms, some of the pieces being of large size.

H. H. Small, in charge of the exhibit of the Central Electric Company, reports some delay in receipt of goods, but already has a fine display of the Okonite Company's wires and cables; the Washington Carbon Company's carbons and various kinds and sizes of tubing and material from the Interior Conduit and Insulating Company, of New York.

The Hope Electric Appliance Company, Providence, R. I., in charge of Mr. Robt. Fessenden, have an exhibit of mast-arms for arc lamps, and various types of switches, both for arc circuits and for primary alternating circuits. This exhibit is also waiting for current so as to be able to show their apparatus in working order.

The Graphophone exhibit in charge of the inventor, Prof. Chas. S. Tainter, attracts a great deal of attention. The professor has not yet located all his instruments, but expects to have them in many localities in the Electricity building, and people can then hear music at all hours for a nickel. The Bradbury-Stone Ideal Battery is in use with the graphophones in this exhibit. The automatic coin action and return on this machine is very complete.

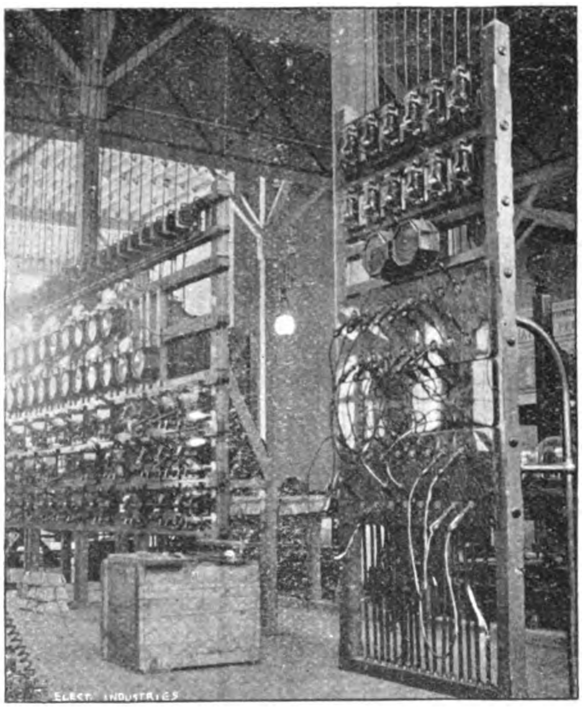
Mr. H. A. Reeves, western agent of the H. W. Johns Manufacturing Company, and in charge of the company's exhibit at the Fair, has had his exhibit in good shape and completed for some time. It is remarkable indeed the many uses that are found for the vulcabeston insulating material in electrical and other manufactures. The company now has control of the Gould & Watson mica insulating materials, and reports business exceptionally good in the railway insulators of various kinds.

The Electrical Engraving Company, of Glen's Falls, N. Y., in charge of Dr. A. H. Phelps, M.D., the inventor of the process, is somewhat delayed for need of current but is taking advantage of the delay to arrange new features in its booth. The Doctor promises an electrical surprise in the near future in lines that have been worked at for some time.

The Electric Heat Alarm Company, of Bangor, Maine, with principal office at 113 Devonshire St., Boston, has a fine display of its system as applied to rooms in hotels and to journal bearings on machinery. It is unique in having a system for testing the circuits all at the same time and recording the test on a chart which lasts for a year.

H. W. Axford, of Cottage Grove Ave. and 45th St., Chicago, has an exhibit of his incubator in which the heat is controlled by an electric thermostat of peculiar form. He has also adapted and shows a sample of this thermostat to a fire alarm system for buildings. The instrument is very simple and easily adjusted for both heat and cold.

The Electric Appliance Company are showing a very attractive line of Meston alternating current motors for special work in their exhibit, space U 16. The Emerson Company, manufacturers of the celebrated Meston motors and for whom the Electric Appliance Company are general western agents, show some new applications of its motors and display their alternating motor applied to a dental outfit and also as a sewing machine motor, both of them being exceedingly practical combinations.



SWITCH BOARD OF FT. WAYNE ELECTRIC CO.

The Transportation building is as far advanced as any on the grounds and is very interesting indeed. In spite of the very great advance made in electric traction during the last few years, strange to say, very little is shown in this building, as it has been quite properly classified with the electrical machinery. The drawings of central stations and several installations by Schuckert & Co. in the southwest corner of the gallery in the German section are quite interesting in comparison with American practice. Prof. Hartmann of the German Technical University, representing the German Society of Engineers and editor of *Verein Deutscher Ingenieure*, together with Mr. J. S. Teucher is in charge of the exhibits of the German engineers. The drawings and models of engineering will well pay close inspection. In the electric business plans and drawings are submitted by Schuckert & Co., Helios Co., Gebrueder Naglo, of Berlin, and Oskar von Miller, of the Electrotechnisches Bureau of Munich. All these plans show the great pains taken to make every detail perfect in the plan before commencing construction.

The Consolidated Car Heating Co., of Albany, N. Y., has a fine display of its various systems of car heating in the Transportation building. They have a street car seat fitted up with their electric car heaters, and a miniature train, piped with three different systems of steam or hot water. The miniature locomotive attached is raised slightly above the rails and its wheels are turning, the effect being a train in full motion. The exhibit is very effective and is well explained and shown by Mr. W. P. Waldman who is in charge. The western office of the company is 200 Phoenix Building, Chicago.

Max Judel & Co., of Baumstadt, has an exhibit of electric railway signals in the south end of the Transportion building near the entrance. As we go to press the exhibit is not quite finished, but it is said it will be very complete. Mr. Heimann is in charge and will gladly show the working to interested parties.

The Siemens and Halske exhibit of electric signals and other appliances for railroads is not quite completed; it promises to be one of the finest shows in the Transportation building and will attract a great deal of interest from American railway men.

Morse, Williams & Co., of 1103 Frankford ave., Philadelphia, Fred Furnival, Manager of Chicago office, in charge, have on exhibition one of their new type electric elevators, using a 15-horse power Perret motor. The apparatus is fitted with a new quick-break switch, which turns on the current in full, the current then energizes the brake magnets and relieves the pressure of the brake, at the same time the current reaches the motor through an automatic rheostat which will not act to cut out resistance and give the motor full speed until the armature has reached 350 revolutions at that speed the counter E. M. F. allows the rheostat bar to be released and the resistance is gradually cut out. This arrangement effectually prevents burning out of the armature through carelessness in starting or overload of the car.

ELECT. INDUSTRIES

VIEW IN THOMSON ELECTRIC WELDING CO.'S EXHIBIT.

The exhibits in the Mines and Mining building will undoubtedly occasion much surprise. All states and countries are represented by their mineral products, and it is astonishing how fine, iron beams, crude ores, pigs of metal and all other minerals can be made to appear under skillful arrangement. The needle of coal from the Girard estate of Penna. that stands in the center of the building attracts much attention. Many paintings of different mine locations are shown and that of a gold and silver smelting furnace at Frankfort on the Main, near the central western entrance is very well executed. The electrical exhibits in this building are confined to the large Westinghouse motors that furnish power for the shafting and to some fine electric drills and mining machinery. Most of the machinery of this nature, however, is to be found in the Electricity building.

Several of the state buildings and some of the foreign have been dedicated during the month and are now open for inspection. That of Illinois is very large, in fact it would do very well for one of the department buildings. Machinery Hall is a trifle slow, but when entirely complete will be one of the most popular and interesting on the grounds.

ELECTRIC LIGHT AND POWER.

EXTENSIONS AND IMPROVEMENTS.

Georgetown, Colo.—The Electric Light & Gas Company has been consolidated and the new organization formed, the United Light & Power Company. An extension of its lines will at once be built to Silver Plume. J. J. De Marr is superintendent.

North Attleboro, Mass.—A committee has been appointed to contract for a municipal lighting plant to cost about $50,-000. T. I. Smith is chairman of committee.

San Pedro, Cal.—The San Pedro Electric Light & Power Company will add an incandescent plant. E. E. Peck is manager.

Astoria, Ore.—The Astoria Street Railway Company will install an arc and incandescent light plant. F. W. Newell is superintendent.

Redlands, Cal.—The Redlands Electric Light & Power Company contemplates adding largely to its power in 1894. It is now operating 750-horse power wheels. H. H. Sinclair is manager.

Mt. Carmel, Ill.—The Mt. Carmel Light & Water Company's plant is now under construction. C. C. McLain is superintendent.

Brandon, Vt.—The Neshote Electric Company is building a new brick station, 42 by 45 feet. E. D. Blacknell is manager.

Tipton, Ia.—The Municipal plant, which was recently burned, is to be rebuilt. It is proposed to instal a complete incandescent plant. W. N. Treichler is superintendent.

Hackensack, N. J.—The Hagensack Edison Lighting Company proposes to build a new station and add largely to its power and lighting capacity. Geo. T. Davison is superintendent.

Stroudsburg, Pa.—The Stroudsburg Electric Light & Power Company will add an engine and an incandescent dynamo. Chas. Bell is purchasing agent.

Lewistown, Mont.—The Lewistown Electric Light & Power Company is now installing an incandescent plant and expects to add an arc plant soon. Cyrus Stiles is president and manager.

Schuylkill Haven, Pa.—The Schuylkill Haven Electric Light Company contemplates increasing its power and equipment. Thomas E. Brickhouse is manager.

Ashtabula, O.—The Municipal Lighting Plant is to have its power and lighting capacity largely increased. J. A. Manning is purchasing agent.

Canton, O.—The Canton Electric Light & Power Company will add an arc dynamo, shafting, pulleys, etc.

Eaton, O.—The Eaton Electric Light & Power Company will duplicate its power and lighting capacity and add an all night service. H. C. Aydelott is purchasing agent.

Cincinnati, O.—The Cincinnati Electric Light Company are building duplicate of its present plant on adjoining lot.

Wahpeton, N. Dak.—The Northern Light Electric Company is now extending its line to Breckenridge, Minn. B. L. Bogart is president.

OBITUARY.

At his home, in St. Louis, Mo., on the 12th inst., Mr. A. W. Meston died of consumption. He had been in failing health for some time, and had but recently returned from his trip to Jamaica where he went, thinking the climate would be beneficial to his health. Mr. Meston had been a resident of St. Louis for the past eight years, and was well known. Some three years ago he engaged in the manufacture of electrical goods with his brother, Mr. Charles R. Meston, which resulted in the formation of the Emerson Electrical Manufacturing Co. He had been a thorough student of electricity and had made the alternating current a special study. He was born in Edinburgh Scotland, in 1867, and was consequently but 26 years of age.

FINANCIAL.

The month of May, 1893, is likely to be long remembered in the financial world of Wall street. The general weakness of the market early in the month, followed by a great fall in the price of stocks had its effect on all the electric securities. The forcing of the Cordage Company into the hands of a receiver, was accompanied by a heavy fall in General Electric and its allies. It dropped to 58, but advanced again to 80, then gradually went down to about 68. It then advanced slightly each day up to the 20th when it reached 80¼. Since then it gradually fell off.

The Boston News Bureau reports that a party of capitalists recently examined into the affairs of this company, and made a report favorable to them, but criticized the policy of the company in holding so many stocks, which might be sold at a premium, while the company had any debt. It is reported that the company has reduced the amount of its holdings of stocks and bonds of local companies during the month. Owing to the rumors floating about, the General Electric Co. felt justified in issuing a statement on the 10th, denying that any reorganization was intended, or that any was needed. They also denied being pressed for money, or that they were about to issue any new securities. They claim that the company is sound, in easy circumstances, and has more orders than ever.

The Edison Electric Illuminating Company's stock weakened with the rest, and dropped to the lowest point reached for some time. There seems to have been no reason for this other than the state of the market, as the company has one of the most valuable franchises and plants in existence. It has advanced slightly since, but is considered a good investment at anything like the present prices. On the 24th notice was given in the daily papers that the General Electric Company had sold its holdings of $1,500,000 in the above company to a syndicate represented by Kuhn, Loeb & Co., bankers. The price is said to have been less than the market price. Whether this is a move on the part of the General Company to obtain money, or whether it indicates a change of policy as suggested by the parties who made the before mentioned examination, can only be conjectured.

The Westinghouse Electric & Manufacturing Company made its annual report, which will be found elsewhere in these columns, during the month, and while it is to be regretted that the details are not given more fully, a good business is shown to exist. The company is reported to have materially reduced its selling and other expenses, and is trying the plan of selling direct to large customers at a manufacturer's profit. Its stock fell somewhat with the rest. Western Union went down with the crowd, but has recovered. This stock is solid, and sure to go to par when the market recovers. All other electric stocks suffered, but General Electric seemed to catch the brunt of the trouble.

We quote the following from the Daily Financial News of Pittsburgh:

> Gov. Flower has signed the bill which makes the formation of a trust in New York state a misdemeanor, and providing a fine of $50,000 and a year's imprisonment as punishment for those violating its provisions. With the leading state governments opposed to them, and a national law forbidding such combinations, it begins to look as if the attempts at monopolies would have to abandon the field.

And again:

> At least one good will result from the recent smashing of the industrials by Wall street. Private or individual capital will not hereafter be so timid about entering into competition with the so-called trusts as it was up to the time of the break, which not only squeezed the water out of the market value of the stocks, but exposed their inherent weakness and rottenness. Outside of the Standard Oil Company, which was in no wise affected, not one of the concerns organized for the purpose of establishing a monopoly in some particular branch of business has been a success, and is not likely to be, because as soon as the price of an article is put up to an undue height other capital will come in to divide the spoil, and the monopoly will be broken and the price decline.

The Boston News Bureau had the following to say about the condition of the money market during the month:

> Every indication is that money will be a drug before long, on time as well as on call. This would enable those who have been obliged to purchase securities as a protective measure the opportunity to establish a higher range of values. Conditions at the moment are not favorable to new enterprises, but the situation is one of recuperation, and one that is attractive to conservative investors. Foundations will be rebuilt, and the structure of trade and finance will be strengthened as conservatism is proven. The level of prices would seem, by comparison with recent years, to be at the extreme of the pendulum swing. After such a decline as has been witnessed a buyer wants profits somewhat commensurate with the decline. A man has confidence to hold his purchases longer when it is apparent to him that he has bought them at an enormous depreciation, the result of money necessities rather than of conditions affecting the intrinsic values of the securities themselves.

NAME OF COMPANY.	DESCRIPTION OF SECURITY.	AMOUNT ISSUED.	PAR VALUE.	RATE INT.	DATE PAYABLE.	CLOSING MAY 25.
Miscellaneous Securities.						
American Bell Telephone Co....	Stock.	$17,500,000	100	....	J. Q.	190
" " "	Bds. 1898.	2,000,000	100	7	F. & A.	110
American Tel. & Cable Co... ...	Com.	14,000,000	100	....	....	81
Commercial Cable Co...	Com.	7,716,000	100	....	....	135
Edison Elec. Ill. Co., Boston ...	Com.	2,025,800	100	....	F. Q.	135
" " " ...	C. Bds. 1898.	71,000	100	6	M. & S.	......
" " "	C. Bds. 1901.	586,500	100	6	M. & N.	......
" " Brooklyn..	Com.	2,500,000	100	....	Q. F.	......
" " " ..	1st. 1940.	500,000	100	5	A. & O.	......
" " " ..	Regis.	....	100	5	A. & O.	......
" " Chicago...	Com.	1,500,000	...	8	Q. F.	......
" " "		....	....	....	....	......
" " New York.	Com.	6,866,000	100	....	Q. F.	110
" " "	1st 191.	3,250,000	100	5	M. & S.	......
" " Phila......	Com.	....	....	....	....	......
" " "		....	....	....	....	......
Fort Wayne Elec. Co...... ..	Com.	4,000,000	25	....	....	9½
General Electric Company.	Com.	30,457,000	100	....	......	72
" "	Prf'd.	4,251,900	100	....	....	......
" "	Deb. 1922.	10,000,000	100	5	J.-D.	88
Gold & Stock Tel. Co....	Com.	5,000,000	100	....	Q. J.	......
Northwestern Gen. Elec. Co....	Com.	1,000,000	100	....	....	......
" " "	Prf'd.	750,000	100	....	J. Q.	......
Thomson Elec. Welding Co......	Com.	1,000,000	100	....	....	......
Thomson European Welding Co.	Com.	1,500,000	100	..	....	......
Thomson-Houston Elec. Co . .	Series D.	1 0,000	10	....	......	6¾
Thom'n-Houst'n Intern. Elec. Co.	Com.	600,000	100		....	....
" " " "	Prf'd.	400,000	100	....	....	......
United Electric Securities Co....	Com.	1,000,000	100	....	....	......
" " "	Prf'd.	1,000,000	100	....	F. & A.	......
Western Union Tel. Co.........	Com.	94,820,000	100	....	Q. J.	84⅞
" "	Var. Issues	13,088,000	100	7&5	M. & N.	......
West'gh'se Elec. & Mfg. Co	Ass'ing.	5,333,940	50	....	....	26
" " "	Com.	3,755,700	50	7	....	45
Electric Railway Securities.						
BROOKLYN—						
Brooklyn City R. R.............	Com	6,000,000	10	....	Q.-J.	......
" "	1st Bds. 1916	3,000,000	100	5	J. & J.	......
Coney Island & Brooklyn R. R..	Com.	500,000	100	....	Oct. 1.	......
" " " ..	1st Bds. 1909	300,000	100	5	J. & J.	......
" " " ..	Certf. 1894.	300,000	100	6	J. & J.	......
BUFFALO—						
Buffalo St. Railway............	Com.	6,000,000	100	5	....	.....
" "	Bds. 1931.	5,000,000	100	....	F. & A.	......
BOSTON—						
West End St. Railway..........	Com.	9,085,000	100	..	J. & J.	55¼
" "	Prf'd.	6,400,000	100	5	J. & J.	79¾
" "	Bds. 1902.	3,000,000	100	....	M. & N.	.....
LOUISVILLE—						
Louisville St. Railway Co........	Com.	5,000,000	100	....	....	......
" "	Prf'd.	1,000,000	100	5	A. & O.	......
" "	1st Bds. 1930	6,000,000	100	....	J. & J.	.....
NEWARK, N. J.—						
Newark Passenger Railway......	Com.	6,000,000	100	....	....	......
" "	Bds. 1930.	6,000,000	100	5	J. & J.	......
NEW YORK—						
Union Railway Co	Com.	2,000,000	100	....	....	......
" "	Bds.	2,000,000	100	...	....	...
PITTSBURGH—						
Duquesne Traction Co........ ...	Com.	3,000,000	50	...	....	28
" "	Bds. 1930.	1,500,000	100	5	J. & J.	100¾
Fed. St. & Pleas. Val. R. R......	Com.	1,400,000	50	....	J. & J.	29¾
" " " " "	Bds. 1919.	1,250,000	100	5	J. & J.	100
Pittsb'gh, Aleg. & Man. R. R....	Com.	3,000,000	50	....		42½
" " "	Bds. 1931.	1,500,000	100	5	J. & J.	101⅜
Pittsburgh & Birming. R. R. ...	Com.	3,000,000	25	....	......	20⅜
" " "	Bds. 1929.	1,500,000	100	5	M. & N.	97⅝
ROCHESTER—						
Rochester Railway Company....	Com.	5,000,000	100	...	....	......
" " "	Bds. 1930.	3,000,000	100	5	A. & O.	.....
ST. LOUIS—						
Lindell St. Railway.............	Com.	2,500,000	100	....	Q.-J.	......
" "	Bds. 1910.	1,500,000	100	5	J. & J.	......
St. Louis & Suburban..........	Com.	2,500,000	400	....	....	......
Union Depot Railway..........	Com.	1,200,000	100	...	....	......
" " "	Bds. 19 0.	1,000,000	100	6	A. & O.	.....

THE RAILWAY EQUIPMENT COMPANY, Chicago, reports contracts made for type "G" overhead material during the last few weeks with Tiffin (O.) Electric Railway Co.; Belle City St. Ry. Co., Racine, Wis.; Norristown (Pa.) Electric Railway Co.; South Chicago City Ry. Co.; Mobile (Ala.) Electric Light & Power Co.; Camden & Atlantic Railroad Co., Atlantic City and Camden; Calumet Electric St. Railway Co., Chicago; Trenton (N. J.) Iron Co.; Columbia (Pa.) & Ironville St. Ry. Co.; Lehigh Traction Co., Hazelton, Pa.; Wheeling (W. Va.) Railway Co.; Wichita (Kas.) Electric Railway Co.; Fox River St. Ry. Co., Green Bay, Wis.; Pottstown (Pa.) Passenger Ry. Co.; Wyandotte & Detroit River Ry. Co., Ecorces, Mich.; Cumberland (Md.) Electric Railway; Montreal (Can.) Street Railway; Independence (Iowa) & Rush Park Railway; Westminister & Vancouver Tramway Co.; Gettysburg (Pa.) Electric Railway; Second Ave. Passenger Railway, Pittsburgh; Pittsburgh & West End Passenger Ry.; Escanaba (Mich.) Electric St. Ry. Co.; Atlantic Ave. Railroad Co., Brooklyn; Hammond (Ind.) Electric Railway Co.

NEW BOOKS.

Knots, Splices, Hitches, Bends and Lashings, by F. R. Brainard, U. S. N., New York, 1893, 99 pages. Illustrated. Practical Publishing Co., 21 Park Row. Postpaid, $1.00.

This book has been prepared for the seaman, yachtsman, canoeist, rigger, builder and mechanic, and in its pages is much information regarding the subjects indicated by the title, which are fully illustrated by numerous cuts.

Alternating Currents of Electricity: their Generation, Measurement, Distribution and Application. By Gisbert Kapp C. E., with an Introduction by Wm. Stanley Jr., 1893. W. J. Johnston Co. Ltd., New York City. Price, $1.00.

The first part of this book is devoted to the explanation of the alternating current and its measurement. The principles involved in the construction of the alternating current machine and its various designs are next taken up, while the remainder of the book is devoted to alternating current motors of the different types so far introduced. The book is designed for non-technical readers, and is so arranged that all complicated mathematical formulæ are confined to the appendices.

The Mineral Industry, its Statistics, Technology and Trade, in the United States and other countries from the earliest times to the end of the year 1892, by Richard P. Rothwell, New York, 1893, Scientific Publishing Co., 27 Park Row. 600 pages, price, paper, $2.00; cloth, $2.50.

Compiled in this work are statistics of the mining industry, including its history, the various uses of the different metals, their reduction, the prices with their history, a list of the more important mines, etc. The various metals and minerals, copper, mica, asbestos, plantinum, asphaltum, etc., enter largely into the manufacture of electrical apparatus and the information regarding them contained in this volume will be of great interest and value to the manufacturer, to the dealer and the user. The large number of professional, scientific and practical men who have been employed in the production of this work, point to the reliability of the matter it contains.

TRADE PUBLICATIONS.

Among the catalogues recently issued is one from O. D. Pierce & Co., Philadelphia, Pa., who are among the pioneers in the electrical business. The catalogue contains an excellent list of goods manufactured and sold by the firm, a list that their extended experience has enabled them to select in the line of electrical house furnishing goods, telegraph and general supplies. It is well gotten up, of convenient size, and arranged in such a way as to present, in an excellent manner to the trade the latest appliances.

In a catalogue of over 200 pages, handsomely printed and well bound, the Railway Equipment Company, Pullman building, Chicago, has presented to the trade a list of the street railway apparatus it manufactures and handles. The list is most complete and includes everything necessary in the construction of a road, from the pick with which the first paving stone is taken up to the punch with which the conductor punches the transfer ticket. The arrangement of the catalogue has been especially well done. A number of tables of sizes of metal plates, wires, rails, etc., and also a number of articles on the different branches of railway construction make the catalogue valuable to all railway men.

The Manhattan Electrical Supply Company, of 36 Cortlandt street, New York, has issued a pocket edition of its catalogue and price list of its electrical novelties, house furnishing goods and standard supplies. Its lists are most complete, almost every article used by the trade being illustrated in this catalogue, and yet it is of convenient size to carry in the pocket. Most of these goods are manufactured by this company which places it in a position to supply almost every want of its customers.

We are in receipt of catalogue from the Commercial Electric Company, Indianapolis, Ind. It contains cuts and descriptions of the different styles of motors, dynamos, power generators, plating dynamos and fire-proof rheostats manufactured by this company, giving the characteristics peculiar to these machines.

In a well gotten up catalogue of 35 pages the Whitney Electrical Instrument Company, of 146 Franklin Street, Boston Mass., presents to the public the different instruments it manufactures. Attention is first called to the features peculiar to this make of instruments, and then each of the standard sizes and styles of instruments, for both central stations and portable use, are illustrated and described.

The New York Insulated Wire Company, 13 Cortland St., New York, has issued what it styles a World's Fair edition of its catalogue and price list of Grimshaw insulated wire, tape and compound on account of their being used to such a large extent in the Exposition grounds and buildings. The frontispiece shows a bird's eye view of the Exposition grounds as they would appear from a point over the lake.

The Armington & Sims Engine Company, Providence, R. I., has just issued a very attractive catalogue. It is well bound and the press work is neatly done, which together with the numerous plates illustrating the various styles of engines, gives it a very handsome appearance. The frontispiece shows the first Armington & Sims high speed engine coupled direct to an Edison dynamo of the "Jumbo" type. The special and important parts of the latest engines are shown in detail. Data taken during tests of the engines are given showing their efficiency.

PERSONAL.

Mr. W. W. Primm, formerly draftsman of the Department of Electricity, has been appointed engineer of that department.

Mr. E. R. Stettirius, a gentleman of wide business experience, has accepted the position of treasurer of the Stirling Company, Chicago.

Mr. Chas. W. Price, of the Electrical Review, was in Chicago last week attending the convention of the National Editorial Association.

Mr. Rudolph Eichemeyer and his partner, Mr. Osterheld, of Yonkers, N. Y., were in the city a few days, recently, for a hasty visit to the Fair.

Francis R. Upton, president of the Edison lamp works, has been exceedingly ill with diphtheria, but is now fortunately out of danger, and has gone to Atlantic City to recuperate.

Mr. A. L. Rohrer, the genial executive electrician of the Schenectady factories of the General Electric Company, was in Chicago for a few days recently on a hurried visit to the Fair, and to look after some of the exhibits of the company.

Mr. W. W. Burnham, treasurer of the Electric Gas Lighting Company, Boston, Mass., was in Chicago for a short time last month on a business trip. While in this city Mr. Burnham also made a brief visit to the World's Fair and was much impressed with its electrical as well as other features.

Prof. Mascart, Paris, has been appointed a member of the international jury for the World's Columbian Exposition for the Department of Electricity, representing France. Prof. Mascart was a member of the jury of the Paris Exposition, 1889, and is well known as an author of numerous articles on electricity and magnetism.

Mr. C. L. Edgar, general manager and superintendent of the Boston Edison Illuminating Co. was in Chicago recently for a few days, making a somewhat hasty examination of the Fair. Mr. Edgar has but recently returned from a visit abroad with Mr. W. S. Barstow of the Brooklyn Edison Company. They made a thorough examination of both English and Continental practice and will immediately put in practice such ideas as they found in any way superior to American practice.

BUSINESS NOTES.

D. W. Davis, the western manager of the Phœnix Iron Works Company, is now located at 519 The Rookery, Chicago.

M. H. Devey, Chester, Pa., has invented a new insulating compound for which he has secured both American and English patents.

George Cutter, 851 The Rookery, is now settled in his new and larger quarters in the Rookery, where he is carrying a full line of P. & S. china switches and insulators.

The Stirling Company, Chicago, owing to its rapid increase of business has been compelled to remove to larger and more convenient quarters at 606 Pullman Building, Chicago.

Mr. Francis M. Ireland, Chicago, has moved his office from the Unity building to 42-44 Metropolitan building, where he will continue the practice of law and the soliciting of patents.

Clark & Marshall, The Rookery, Chicago, have secured the local agency for the Menominee Fan Motors and D. L. Bates & Bros.' Star Ceiling Fans. They report an excellent trade in these goods.

The Columbia Lamp Company, St. Louis, is enjoying the well-earned reward of Mr. Rhotehamel's efforts in the recent lamp litigation, in the large number of orders it is receiving for the Columbia Lamps.

W. R. Ostrander & Company, New York, have recently removed from 195,197 to 204 Fulton street, where they will carry a full stock of the well-known electrical house-furnishing goods which they manufacture and which have been so well appreciated by the trade.

Cushing & Morse, 225 Dearborn street, Chicago, are out with a neat and altogether surprising piece of fireworks for advertising Day's Kerite insulation. It is another case of you touch the button and the card does the rest.

The National Water Tube Boiler Company, New Brunswick, N. J., is placing its boilers in the power station of the North Shore Traction Company at Salem, Mass. The work is being pushed forward as rapidly as possible.

The La Roche Company, Philadelphia, Pa., is now making arrangements for increasing its manufacturing facilities which has become necessary on account of its increasing business, especially in La Roche dynamos and motors.

The International Trading & Electric Company, New York, has removed its offices from the Times building to 40 Courtland street, where it has secured larger facilities for handling its export trade in electrical apparatus.

J. Grant High, 123 N. Third St., Philadelphia, recently commenced the manufacture of new single and double pole knife switches. For this purpose he is adding new machinery and tools which should turn out a switch first class in every respect.

The Nutting Electric Manufacturing Company, Chicago, has secured new quarters for its factory at 128-130 So. Clinton St., and is rapidly recovering from its loss by fire. Preparations are being made to increase the output of the Nutting arc lamp in the various styles.

The Fidelity Carbon Company, St. Louis, through Mr. S. G. Brooker, reports a lively trade in carbons and a number of very large orders, among which is one of 1,500,000 from the manufacturers of the Ward lamp, also contracts from the New Orleans and St. Louis municipal lighting companies.

Queen & Company (Incorporated), Philadelphia, in a neat little pamplet, gives a large amount of information of value to visitors to Chicago and the World's Fair in connection with a description of its exhibit. Copies are distributed free, and our readers will find its contents interesting and valuable.

L. J. Wing & Company, 126 Liberty St., New York, report a good number of recent orders. The business of this company, the manufacture and sale of exhaust and ventilating fans and high-speed power machinery, has been conducted in a manner which must be very gratifying to the stockholders as well as the officials and directors.

Taylor, Goodhue & Ames, 348 Dearborn St., Chicago, are getting used to their new quarters, and are now better able than ever to handle the growing trade. Since the recent Columbia lamp decision, the trade in Columbia incandescent lamps has been large and the few warm days has given an impetus to the sale of Wagner fan motors.

The Wagner Electric Manufacturing Company, St. Louis, is bringing out a line of motors for which are claimed many advantages. A rush of orders has been received which has taxed the capacity of its factory, and plans have already been made for the erection of an additional building, which will give them facilities for handling their large and growing trade.

The National Association of Stationary Engineers has secured headquarters at 179 and 181 Lake street, for the reception of its members visiting Chicago during the World's Fair. Arrangements have been made to care for the wants of visitors, and persons in charge of the headquarters will take pains to supply them with any information in regard to Chicago and the Fair.

Elbert Dills, superintendent of the electric lighting plant at Sprague, Wash., has recently invented an electric lamp hanger that will be very useful where a light is desired that may be carried to any part of the room and especially around machinery. It allows the cord to be drawn out to any distance; the hanger winds up the slack so that there is no loose cord to be in the way.

The Enterprise Electric Company, Chicago, reports that at present its trade in Holtzer-Cabot motors for both fan and power purposes is especially good. The demand for N. I. R. wire, which the company is agent for in the west is also having an enormous sale, so that it is with difficulty that the company can take care of its orders, a fact which speaks well for the merit of the wire.

The American Electrical Manufacturing Company, St. Louis, Mo., equipped in January, 1892, the Missouri Safety Deposit Company with 23 of its lamps, and at the present time 21 of these lamps are in use giving an average life of over 3,500 hours. The trade mark adopted by this company for these lamps is a fac-simile of the somewhat striking handwriting of Mr. Louis Nahm, the secretary and treasurer of the company.

Huebel & Manger, 2861 Graham street, Brooklyn, N. Y., have found it necessary, owing to their greatly increased business, to make some very important changes in the arrangement of their factory which gives them nearly twice as much room as well as better facilities for handling their trade. A very pleasant and commodious office has also been arranged which places them in an excellent position to handle their business.

The Western Electric Supply Company, St. Louis, reports a number of large contracts, among which is a contract for several miles of wire for the St. Louis municipal plant. The fact that the wire manufactured by the Great Western Manufacturing Co., of Chicago, of which the Western Electric Supply Company is a branch, was specified for this contract is considered an evidence of the excellent quality of this brand of wire.

The Washburn & Moen Manufacturing Company, Worcester Mass., have recently secured some very large orders for wire to be used on street railways. It has been their intention to produce nothing but a high grade of wires, which undoubtedly accounts for the number and size of orders received. Their manufacturing facilities will soon be increased by the erection of a large and commodious factory at their south works, which will be equipped with the most modern machinery.

The Buckeye Electric Company, Cleveland, O., reports that it is at present deluged with orders, the reason for which, as it is claimed, being the "known quantity" of the lamp. Mr. J. H. Cooke, the western representative of the company, who has offices in the Rookery, Chicago, is preparing to give the western trade prompt deliveries. He says that his present stock is 30,000 lamps in standard voltages and candle powers, and that this number will be increased as rapidly as possible to 50,000.

The Knapp Electrical Works, Chicago, are now represented in St. Louis by a new company called the Commercial Electric Company, 821 Pine street, of which Mr. M. A. Knapp is vice-president, Mr. Ernest Michaelis being president and treasurer, and Alfred C. Einstein secretary. This gives the Knapp works a branch house in St. Louis, where will be kept in stock a full line of their well known supplies and specialties comprising Safety wires and cables, annunciators, etc., and enable them to make prompt shipments either in retail or wholesale quantities.

The Ansonia Electric Company, Michigan avenue and Randolph street, Chicago, reports the following recent orders: A 30-ton order for P. & B. line wire, a large contract for Helios arc lamps for street and commercial lighting in Iowa, a contract for the overhead equipment of 13 miles of road running between Goshen and Elkhart, Ind., also for some 1,800 ampere Wirt indicators as well as numerous orders for general supplies. Another order recently secured by this company is for a supply of Stanley transformers to equip the entire plant at Columbia, Mo. Arrangements have been perfected by which the new W.-W. lightning arrester, for which there has been such a large demand, can be furnished in large quantities on short notice.

The Ball Engine Company, Erie, Pa., reports the following list of orders as among those recently taken: Brockton Street Railway Company, Brockton, Mass., 600-horse power cross compound engine; Far Rockaway Electric Light Company, Far Rockaway, Long Island, 125-horse power engine; Bradford Electric Light Company, Bradford, Pa., 200-horse power single cylinder engine; H. F. Watson, paper manufacturers, Erie, Pa., 500-horse power compound engine; Intermountain Electric Company, Salt Lake City, Utah, 130-horse power engine; Fond du Lac Light, Power & Railway Company, Fond du Lac, Wis., three 100-horse power tandem compound condensing engine; Compania Mexicana Del Gas y luz Electrica, 100-horse power cross compound engine and other material.

The Electrical Appliance Company announces that the new Whitney voltmeters and ammeters are now ready for the market. The difficulties which have heretofore been experienced with alternating instruments caused by varying frequencies have been overcome, and this new instrument can be placed on any circuit without a special recalibration and gives correct readings. This being the case these instruments will be greatly appreciated and will undoubtedly receive a large demand. It is now supplying its customers with a new catalogue of Meston motors, showing its various adaptations for ventilating, dental, sewing machine and light power work, which is the first catalogue of this kind issued. It also contains some interesting reading matter and valuable information for users of the alternating current.

The Elektron Manufacturing Company, 60 Wilbraham Road, Springfield, Mass., is experiencing a very lively demand for their improved electric elevators, and for the convenience of customers in that vicinity it has recently opened an office at 103 Milk street, Boston. Mr. E. E. Marshall, has been placed in charge of this office, being a recognition of the ability he has shown in his previous experiences, and he will, undoubtedly, handle successfully any business that may come through this new Boston office. Mr. Marshall has had a long experience in the elevator business in connection with the Otis & Graves hydraulic and power apparatus. From this office has recently been installed electric elevators for Messrs. Curtis & Bolster, 2304 Washington street, and Frank Ferdinand, 2280 Washington street, Boston. From the main office at Springfield has recently been sold electric elevators to the new Masonic Hall, Springfield, Mass., one of the finest buildings in the city, Brown, Thompson & Company, dry goods store, Hartford; and a second elevator to W. H. King & Sons, paper dealers, Springfield.

ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. July, 1893. NEW YORK. No. 7.

Interior Arc Lighting at the World's Fair.

In the study of the lighting of interiors of very large buildings, the World's Columbian Exposition offers opportunities that were never before and possibly will never again be available. The large spaces to be lighted precluded the use of any but arc lamps for general illumination. As all the larger buildings are lighted throughout by arc lamps it will suffice to describe a few of the more important ones. The circuits and position of the lamps are shown in the accompanying cuts.

The contracts for the lamps for the buildings were divided among the different companies as follows: Western Electric Co., 400; Brush Electric Co., 300; Standard Electric Co., 750; General Electric Co., 1,200; Ft. Wayne Electric Co., 160; Excelsior Electric Co., 200; making a total of 3,010 arc lamps for this purpose, all of the ten ampere standard.

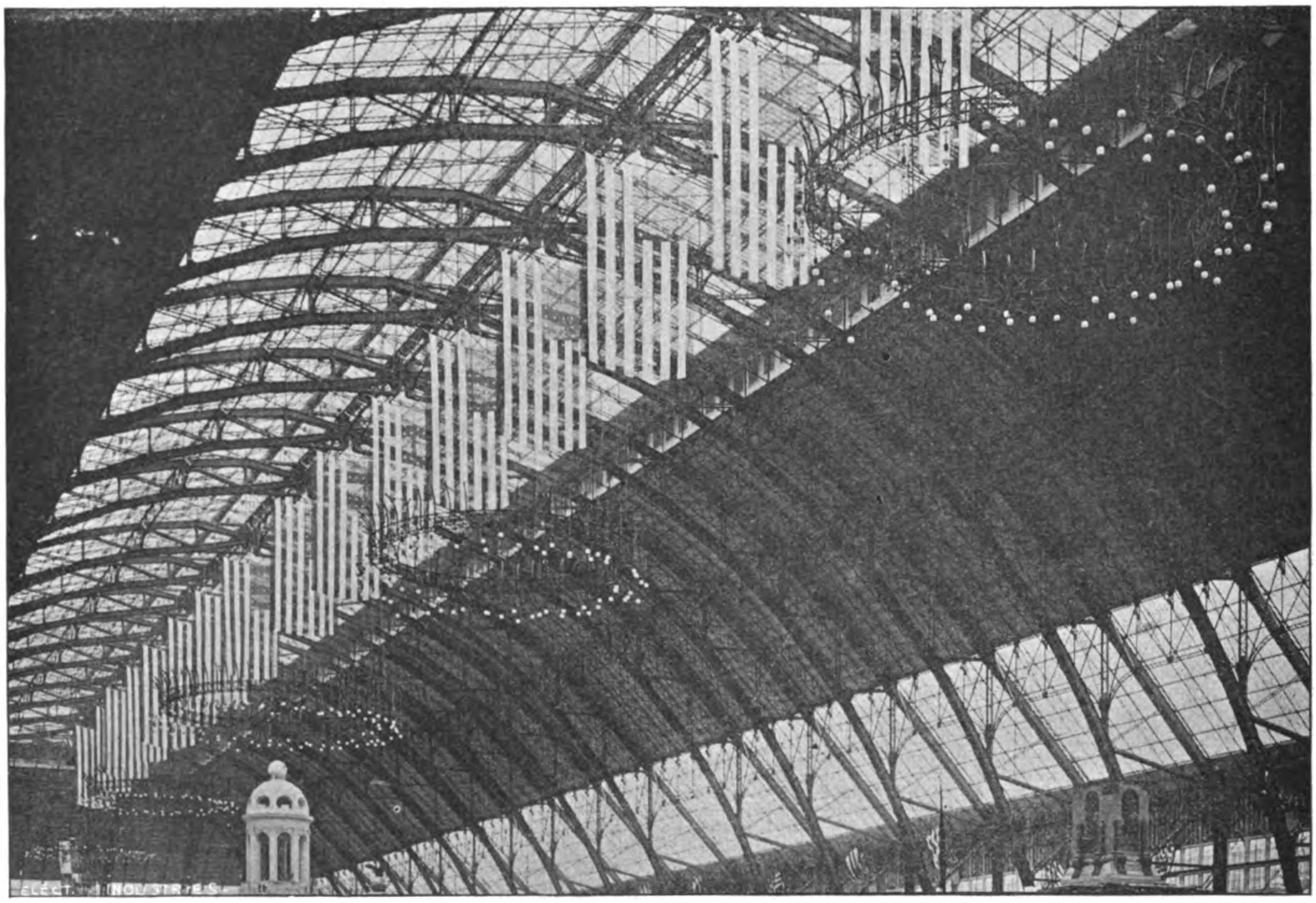


FIG. 1.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—THE FIVE CORONAS, MANUFACTURERS AND LIBERAL ARTS BUILDING.

The circuits, starting from the service switch boards in Machinery Hall, are run through the large subway to the different buildings, each circuit being provided with an arc cut-out switch where it enters the building, for use in emergency, at all other times it is cut in from the service boards. All risers from the subway to the ceiling are carefully protected and where necessary interior conduit tubing has been used. The number six B. & S. gauge wire used for the arc lighting is braid and rubber covered, made by the Safety Insulated Wire & Cable Co., of New York, and is run on glass knobs and Pierce Porcelains beneath the floor or near the ceilings, except in the high open spaces where it is run from lamp to lamp and strained taut. Great care has been exercised to keep the lines straight and all the angles square and abrupt.

The lamps are all suspended from a special casting fitted with porcelain insulators. This device was especially designed for the purpose in the engineering department and supplies a long needed article. There are four forms of it; one for bolting directly to the underside of a ceiling, and used for continuous straight runs, shown in fig. 6; another very similar but used for suspension by wires from high points, and others for three-way pull-offs and for the crossing of lines, the former being shown in fig. 5.

This fixture is attached either by fastening to a beam or hanging from a wire. The lamp is suspended from the lower of the three porcelains and the wires are then brought each way to the end knobs, given a turn around the knobs and one or two around the wire itself for security then carried to the lamp terminals. One of the knobs on the three-way hanger is used for a guy wire. Without the use of these or similar fixtures it would have been impossible to construct the lines in the very neat manner in which it has been done. The engineers in charge are to be commended for the ingenuity shown in the device.

The lamps in almost all of the large buildings have been hung in the center of the aisles about fifteen feet above the floor and from 20 to 30 feet apart according to the nature of the exhibits. The arrangements of the lights in two of the larger buildings are shown in the accompanying diagrams: the Manufacturers and Liberal Arts Building and the Transportation Building, as the important features of the system are shown to best advantage in these buildings. To be sure there are special points in such buildings as the Fisheries and Fine Arts, and the Electricity Building also has many special features, but these have been introduced more for ornamentation and for the illumination of special spaces.

The lighting of the Manufactures and Liberal Arts Building was a problem such as had never before been presented to Electrical Engineers. The great height of the main arches, some 250 feet, and the enormous area filled with booths, towers, buildings and decorations of every nature, rendered any of the usual methods entirely useless. The plan finally adopted, due probably to the consulting engineer, Mr. Luther Stieringer, was the suspension from the roof and trusses, 140 feet above the floor, of five coronas constructed of angle iron supporting a row of arc lamps on both the inner and outer edges of the circle. The central corona, as it is called, suspended immediately over the clock tower is 75 feet in diameter and has 98 General Electric lamps for evening circuits and four Brush lamps for patrol service suspended from it. The four end circles are each 60 feet in diameter and hold 72 General arcs for evening service and six Brush arcs for patrol service. A light iron truss bridge three feet in width crosses each circle and a well guarded foot-way for the trimmer is also provided for on each circle. The trimmer ascends one of the large iron trusses to the extreme top and decends to the cross bridge by a central shaft and ladder which also serves for a support for the corona. The inner and outer circles of lamps are on different circuits and it has not been necessary so far to light both circuits of all the coronas in order to properly light the building.

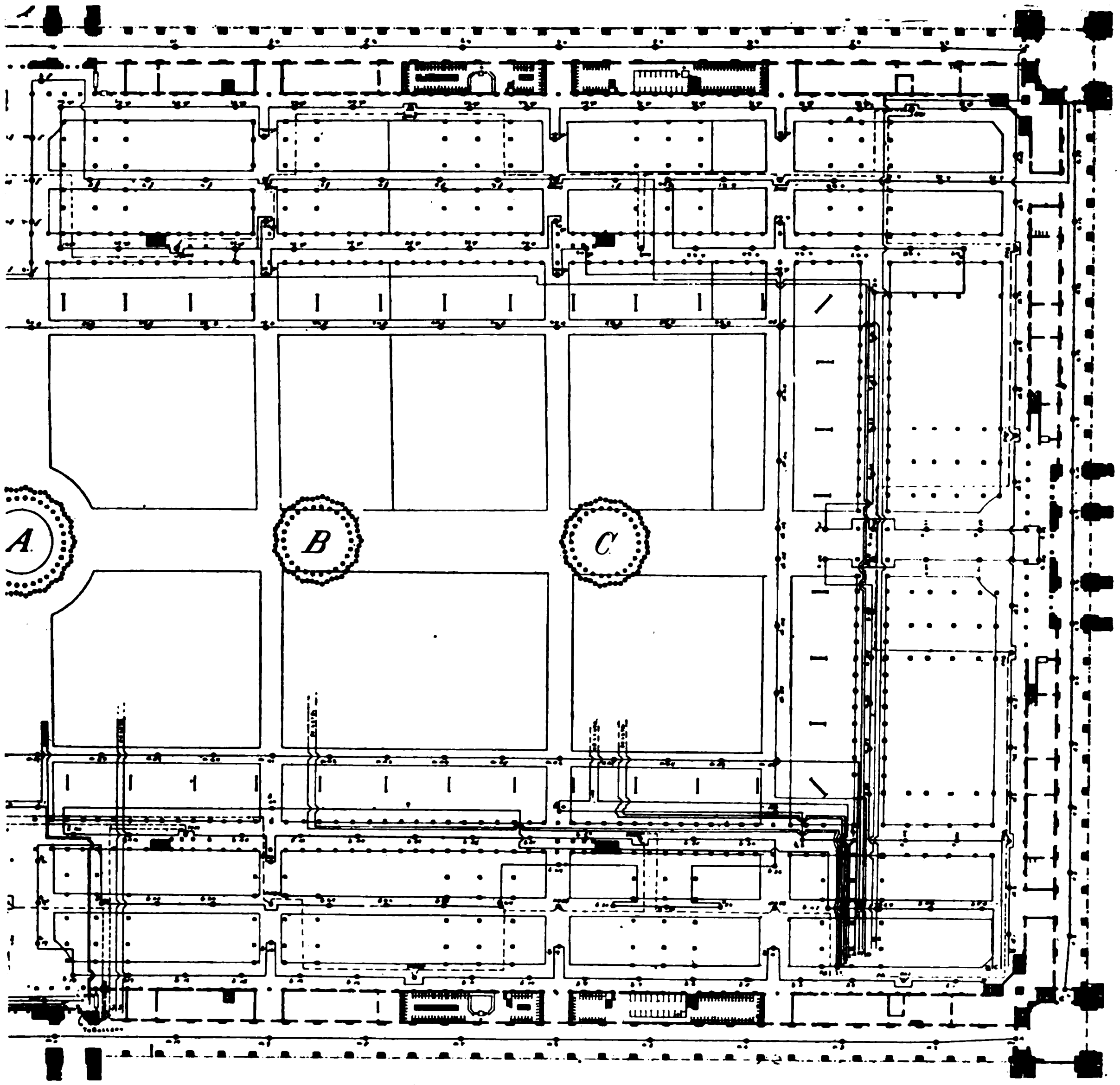


FIG. 2.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—PLAN SHOWING LOCATION OF LIGHTS ONE HALF MANUFACTURERS' AND LIBERAL ARTS BUILDING.

The lamps are suspended in pairs from cords passing over suitable braces and pulleys, an inner lamp and the corresponding outer lamps being supported one at each end of the same rope, the one balancing the other. The circuit wires run from one lamp to the next in free loops, allowing the raising and lowering of the lamps for trimming. This manner of lighting the building has proved very satisfactory and although it is not so brilliant as one or two of the other buildings, it will probably be agreed that the diffusion is fully as good and in spite of the many large booths and other obstructions, some of them very high and complicated in their ornamentation, it is entirely satisfactory as a whole.

The other aisles both main and side are lighted by the regular arrangement of arcs suspended from the gallery floors and where there are no galleries the lamps are suspended from slender wires fastened to the girders and trusses above. In this building there are in all 1,100 General and 96 Brush arcs.

The Transportation Building does not offer any particular difficulty such as the Manufactures and Liberal Arts Building, but the dark color of many of the exhibits made it necessary to place lamps at somewhat shorter intervals along the center of the aisles; therefore it is probably one of the most brilliantly lighted of any on the grounds. The annex is lighted entirely by Helios alternating arcs placed three in series using the Westinghouse alternating current of 100 volts supplied from the same lines as the incandescent lighting. As the exhibit in the annex is made up almost entirely of locomotives and cars, naturally of a dark color and with narrow aisles, it takes 149 lamps to do the work satisfactorily. The main part of the building is equipped with 291 Western Electric Company's lamps for evening service and 26 of the same make for patrol service. The lighting of Machinery Hall was one of the least difficult as far as the nature of the exhibits was concerned, being very open and comparatively low and consequently not interfering to a great extent with the diffusion of the light. The placing of lamps along the centers of both of the lateral and transverse aisles and at a height such as not to interfere with the traveling cranes, sufficed for all purposes. The annex of this building is lighted largely by the multiple series system, the lamps being placed ten in series across 500 volt mains. In the whole building there are 116 Standard Electric Company's lamps, 50 General Electric, 118 Ft. Wayne, 21 Brush and 160 General Electric multiple series lamps. As the insta'lations in this building are not as yet complete the lights have not all been required so that it is difficult to form a definite idea of just the effect of a full illumination. The lines, though hurriedly put up and in some cases showing imperfect connections, which on examination have been easily made good, show very high insulation.

They are tested by a magneto at closing time in the morning and again before starting in the afternoon, for grounds, crosses and open circuit. Lights are started at between six and seven P. M. The evening service is extinguished at 11 P. M., and the patrol circuits run all night. The patrol lamps in buildings as a whole average about 25 per cent of the total.

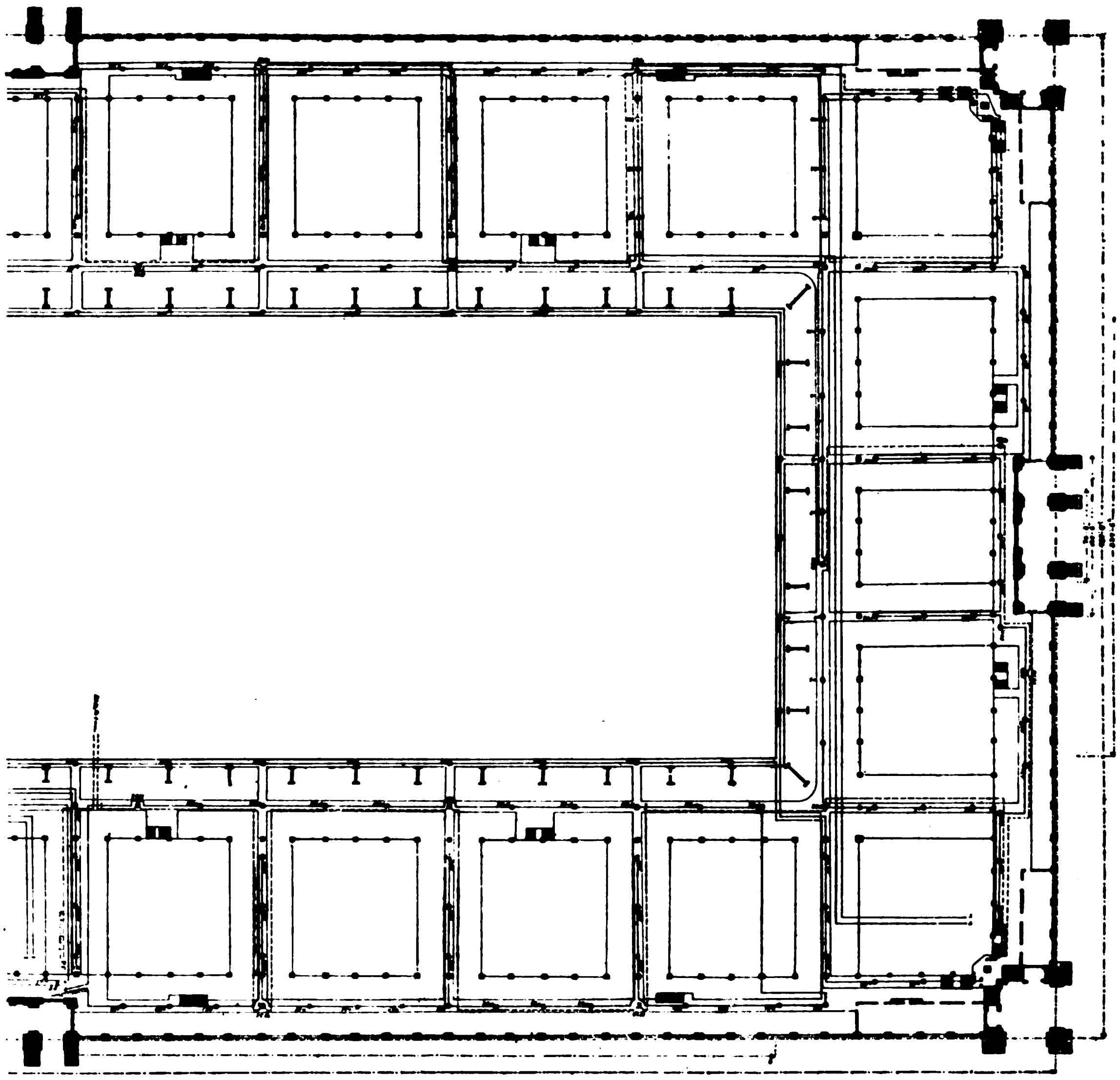


FIG. 3.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—GALLERY MANUFACTURERS' AND LIBERAL ARTS BUILDING.

There is one head trimmer who has charge of the trimming of all the lamps inside of buildings under whom there is a head trimmer for each building with a corps of assistants. Each trimmer trims and cleans about 125 lamps per day. There is also a force of inspectors of arc lamps nearly equal in number to the trimmers. Copper coated carbons seven-sixteenths of an inch diameter are used. The glass globes are provided with nets for safety in case of breakage.

Although one cannot help feeling that the successful installation of so many lamps over so wide an area was no small task, it was only one item of a great number that have been brought to a very successful termination by the same engineers and like all they have done reflects great credit on their ability. The whole was planned by Mr. Frederick Sargent, Mr. R. H. Pierce and their assistants. Mr. George B. Foster has been in direct charge of all arc lighting with Mr. A. P. Peck as his assistant.

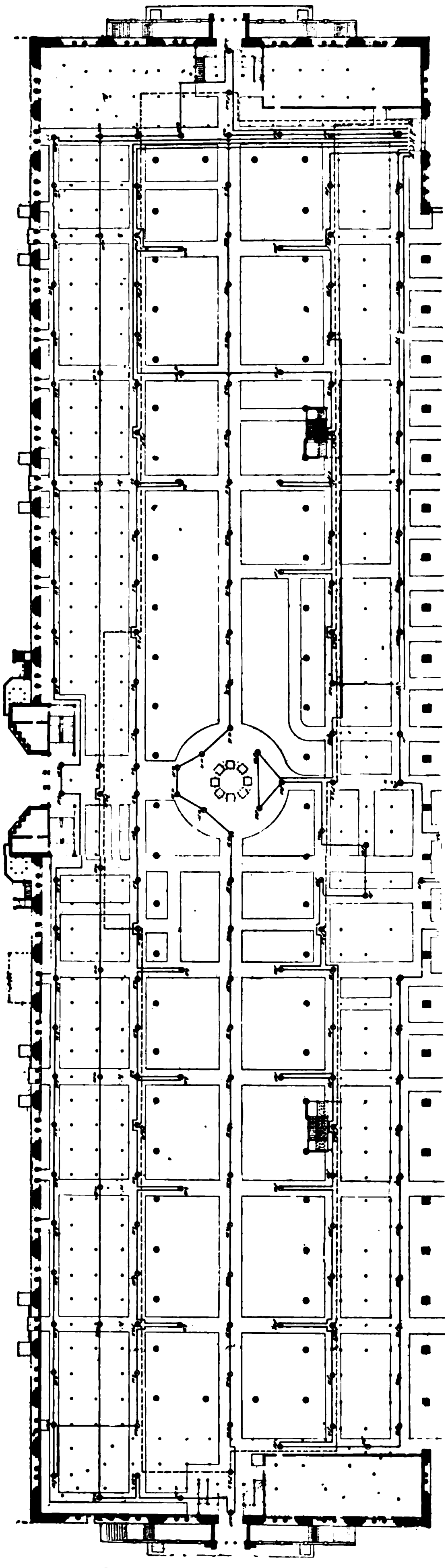


FIG. 4.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—MAIN FLOOR TRANSPORTATION BUILDING.

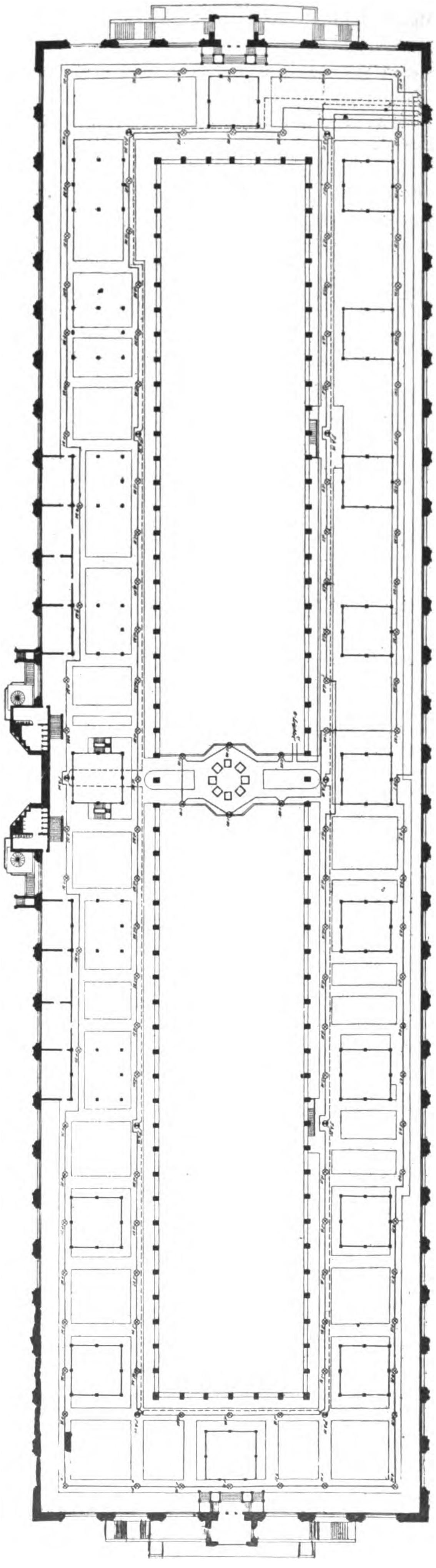


FIG. 5.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—GALLERY TRANSPORTATION BUILDING.

Oil Burners in the World's Fair Boiler Plants.

During the past ten years the use of oil as a fuel has risen and declined in popular favor as new discoveries and applications of it have been made. The cost of the necessary plant that prohibits its use among the smaller users of steam and the supply of oil which has at times been questionable have limited its adoption. Since the larger opening of the Ohio oil fields and the discovery that the residuum could be used as well as the crude petroleum the business has increased to so large an extent as to tax the facilities for the manufacture and the installation of the apparatus.

Oil is more uniform in quality and efficiency than coal, and consequently, in comparison with it, the results vary according to the character of the latter and manner of firing. With a good quality of coal and careful firing, one ton of coal will produce the same evaporation as three and one-half barrels of oil, while with a common grade of coal and careless firing two barrels of oil will give as good results. One pound of fuel oil will evaporate on an average 15 pounds of water at 212 degrees, costing not over 72½ cents per barrel of 294 pounds, or 0.246 cents per pound.

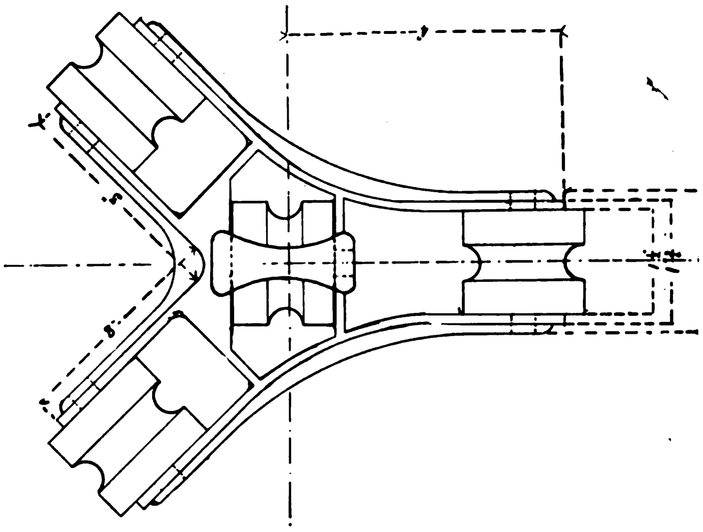


FIG. 5.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—THE THREE WAY HANGER.

In the matter of handling there is no comparison between the two. Oil is supplied to the fire wholly by mechanical means, and the method of controlling it is by the simple turning of two valves, one controlling the supply of oil, the other the amount of steam or compressed air used for atomizing the jet of oil.

The choice of oil for fuel at the World's Columbian Exposition was fortunate indeed as it saves incalculable dirt and ashes, incovenience to visitors in inspecting the exhibits of boiler plants while in use, and an army of employees as firemen.

It is not the purpose of this paper to enter into a full description of the entire plant at the Fair, but to go into a more detailed explanation of the plant supplied for the boilers of the Intramural railway, believing that, as this is considered the most comprehensive oil plant designed for any such work, that the engineering details would be of interest to our readers. The oil burning system for the main boiler plant is similar, but of larger size. The cuts show a cross section of the burner used, a view of the entire plant itself, a plant and elevation of the same and an outline of the position of the burner in the firebox. The apparatus employed is very simple, requiring very little attention, the burner being nothing more than an atomizer supplied with a steam pressure of a hundred pounds through a half-inch pipe and with oil at a pressure of about 13 pounds. The construction of the atomizer itself is also very simple, consisting of a small steam pipe within a larger pipe through which the oil flows. The steam pipe is reduced gradually near the end, as is also the larger pipe. The position of the pipes as well as the steam controlling arrangement is well illustrated in the accompanying cut. Four of these atomizers are placed just inside the furnace door of each boiler in this plant, the intention being to supply one burner for each two and one-half feet in width of fire box.

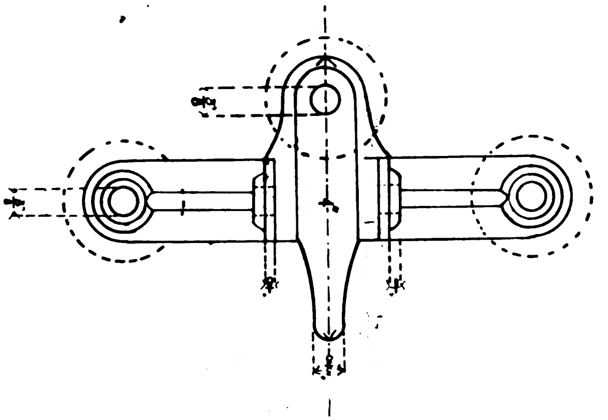


FIG. 6.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—THE TWO WAY HANGER.

Taking the place of the usual bridge wall is an arch of fire-brick, or rather the bridge wall itself has been built up higher and curved forward toward the burners, its face forming one half of a circular arch fronting on the furnace doors. The burners are pitched toward the bottom of this arch four feet, four and one-half inches away in such a manner as to give a rotary motion to the flames after striking the arch, the object being to produce a thorough mingling of the gasses and air and thus complete combustion.

For supplying oil to the burners a steam pump is used, drawing its supply of oil from two inch pipes leading from the storage tanks. In order to comply with the requirements of the underwriters a stand-pipe is provided of height sufficient to give the correct pressure needed at the burner. This stand-pipe has an overflow pipe on one side near the top, which, in case the pressure from the pump increases or the supply is too much, conveys the surplus oil back to the storage tanks. The fuel supply is stored in large tanks buried in the vaults under the ground adjacent to the building. These tanks are three-sixteenths inch steel, 25 feet long and eight feet in diameter, supported in a horizontal position on brick saddles. The vaults in which the tanks are located are built in the ground with side walls of

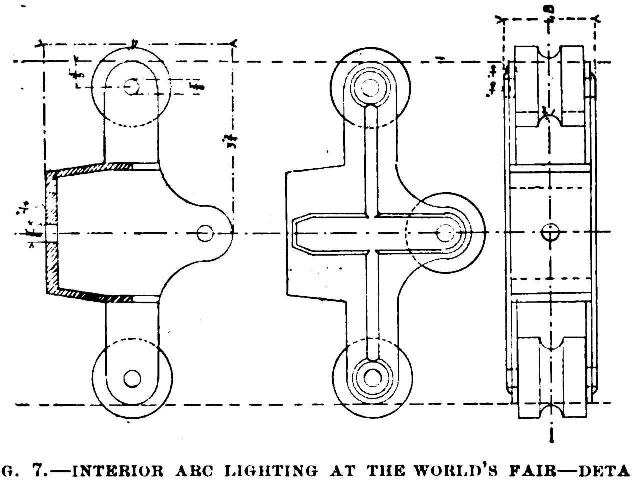


FIG. 7.—INTERIOR ARC LIGHTING AT THE WORLD'S FAIR—DETAIL OF THE TWO WAY HANGER.

hard brick laid in cement, a floor of concrete 15 inches thick and covered with a roof built of I beams supporting brick arches, laid in cement, the whole being covered with a layer of earth. The vaults are practically air-tight, and each tank is separated from its neighbors by thick division walls, thus decreasing the fire risk. Receptacle holes for any water that may accumulate are provided, and a steam syphon removes it as fast as it comes. Pipes are led into these tanks from the outside, a four-inch for delivering oil from the pipe line or from the cars. An overflow pipe six inches in diameter takes care of any surplus that the tanks will not hold. A two-inch pipe for showing the amount of oil in the tank by means of a float; a six-inch pipe for delivering the supply to the pumps, and one-inch steam pipes leading to a coil with six return bends inside the tanks for keeping the oil flowing freely during cold weather, constitute the piping system. This device is necessary in this case as a reduced fuel oil of 30 degrees is used, and hardens or thickens much easier. As will be seen by the plans which were taken directly from the engineers' tracings, numerous valves are placed, controlling the feed and supply of both steam and oil, the arrangement being in duplicate and

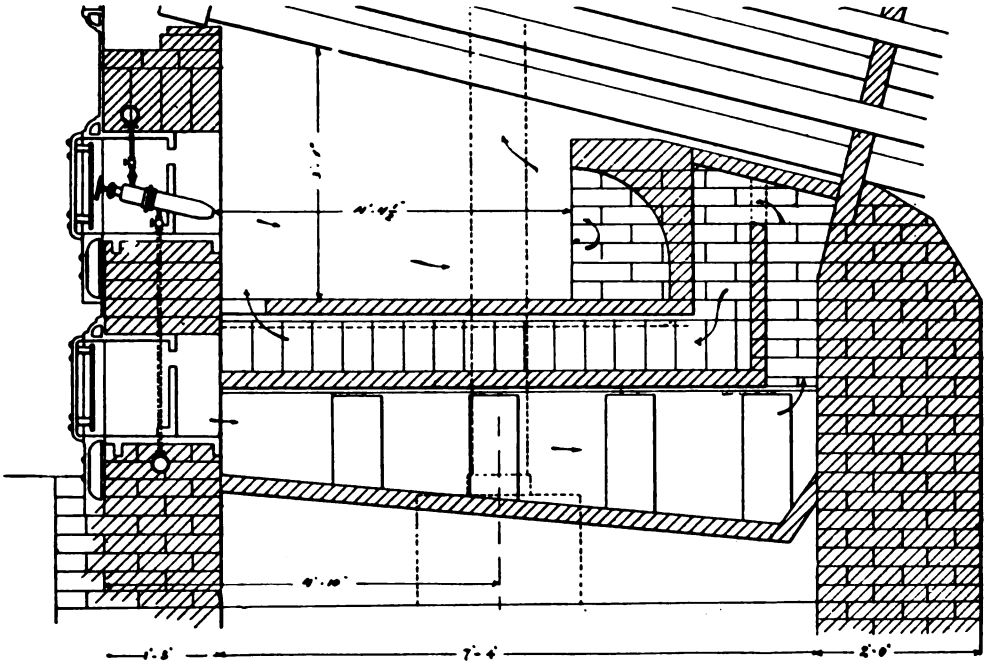


FIG. 1.—OIL BURNERS IN THE WORLD'S FAIR BOILER PLANT—DETAIL SHOWING POSITION OF OIL BURNER.

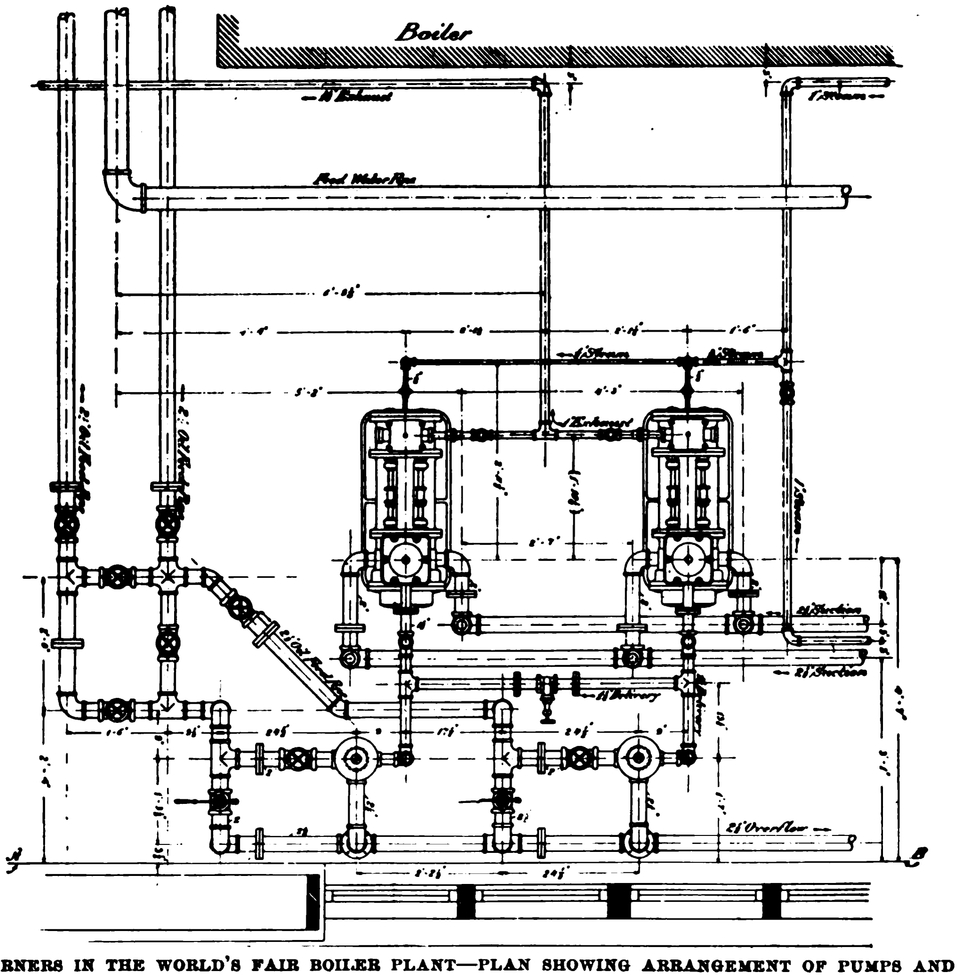


FIG. 2.—OIL BURNERS IN THE WORLD'S FAIR BOILER PLANT—PLAN SHOWING ARRANGEMENT OF PUMPS AND FEED PIPES.

as simple as the nature of the circumstances will allow. The engineers claim to be able to raise steam from water at 50 or 60 degrees in from 30 to 45 minutes, according to the emergency arising, the slower plan being of course better for the boiler. A large number of boilers have been tried in connection with boiler plants, but the National Supply Company, who are the engineers and contractors for this work, have in use now only the most simple form they can get, and that one has been devised by themselves, and is the one shown herewith.

The use of fuel oil seems to be growing, and under circumstances which lead one to think it may now be a permanent success, and it is said by a representative of the Standard Oil Company, who is furnishing this fuel, that the supply is now large enough to warrant its more general use in the larger steam plants.

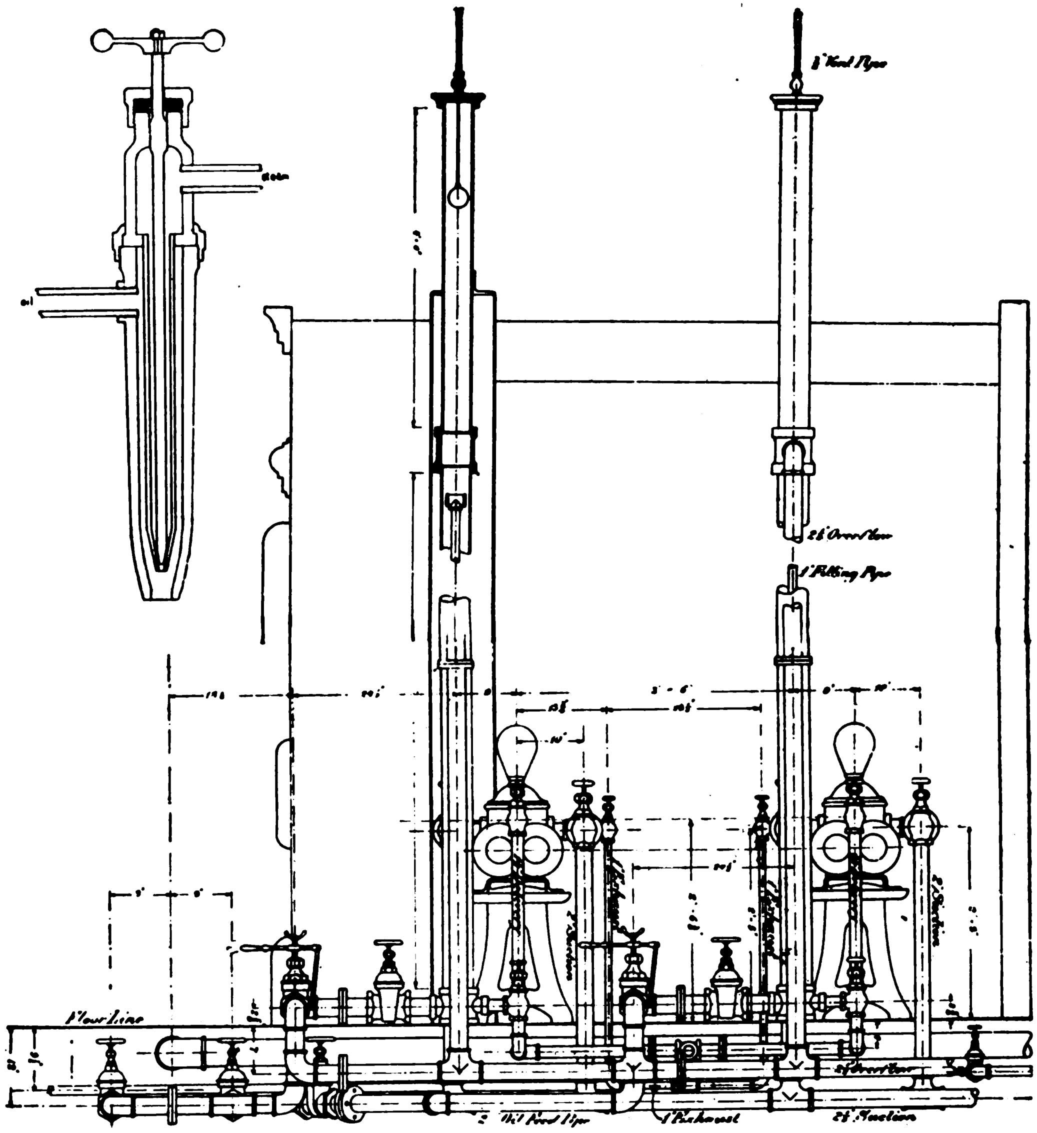


FIG. 3.—OIL BURNERS IN THE WORLD'S FAIR BOILER PLANT—ELEVATION SHOWING STAND PIPES AND PUMPS, ALSO DETAIL OF OIL BURNER.

Dynamos run by Gas and Oil Engines.

As yet very little has been done in the United States in the way of running dynamos by gas or oil engines. Many types, however, of both of these are shown in Machinery Hall. Among those deserving special mention is the safety oil engine, a three and a half horse power machine after the Hornsby-Akroyd patent, and made by R. Hornsby and Sons, Limited, of Grantham, England.

This engine using crude petroleum of 300 degrees flash test is said to consume but three-quarters of a pint of oil per hour per horse power, and as run at this exhibition fuel for it is said to cost less than a cent per hour. The supply of oil is carried in a tank forming a part of the foundation box, and is automatically pumped into the combustion chambers as needed after the machine is started.

The engine is somewhat like the Otto gas engine, and works on the Otto-cycle principle. A hot combustion chamber at the rear end of the cylinder receives oil and air, vaporizes the former, and after mixing it with the air the gas thus formed is exploded by the compression of the piston forcing it into and against the hot combustion chamber. To start the machine, a lamp underneath this combustion chamber is lighted, and a blower provided for the purpose is turned by hand to heat the chamber up to a cherry red. When this is accomplished, which takes but three or four minutes, the light is extinguished and the chamber is kept hot by the compression and explosion of the oil gas, an explosion taking place once during each two revolutions of the fly-wheel.

This particular engine is belted to a Castle dynamo of 24 lamp capacity, and the regulation of speed is very perfect, no variation being noticeable when the load is all cut off or all thrown on. The dynamo was built by J. H. Holmes & Co. of Newcastle-on-Tyne, England, and is of much the same type as the Crocker-Wheeler dynamo of this country. It is very slow speed for the size, running at not over a thousand turns per minute. There is a large field here for engines of this type as the Americans have scarcely become aware of the fact that oil engines are very useful as well as inexpensive for producing electric currents. The foreign firms at the Fair have already noticed this fact and are preparing to supply the demand.

The Jamstown, New York, Municipal Lighting Plant.

This plant was started July 4th, 1891, and has probably been as successful in its operation as any like plant in use by a municipality. While electric lighting exists there will be more or less dispute between the parties running private plants and the municipal corporations doing the same.

It is fair to assume that man will attend more closely to the details of a business in which he is financially interested than to those with which he has only a casual citizen's connection. Our city governments improve somewhat and in the smaller cities where every citizen is able to know all the details of every department, the officials in charge are apt to pay closer attention to the business and the consequence is that some things are accomplished at exceedingly low rates.

As the electric lighting of a city's streets by the municipal governments themselves is a comparatively recent thing it is hardly fair as yet to make comparisons of figures; still the figures are very interesting and instructive. The station here described is a good example in size and other conditions of what has been done in the past three years, but the results obtained are probably better than the average. The station is a plain, brick building two stories high oblong in shape. It is located on the river bank not far from the center of the town. The second or upper story is used for a store room and needs no further mention. A railroad track runs immediately in the rear of the station and coal is unloaded directly from the cars into the bins. Soft coal costing from $1.65 to $2.00 per gross ton is used.

The boiler room occupies about one third of the building at the river or rear end and is equipped with two Manning vertical fire tube boilers rated nominally at 175-horse power each. The shells are five feet in diameter and contain about 180, 2½ inch tubes 15 feet long. The fire box is six feet inside diameter and about four feet high from the surface of the grates to the crown sheet. These boilers are very efficient, tests from similar ones having developed an evaporation of 12 pounds of water to a pound of combustable from and at 212 degrees. In the main room of the station, the floor of which is a few feet above the level of that of the boiler room, are located the engine, shaft, dynamos, switchboards, condenser, feed pump and heater.

The engine is of the tandem compound condensing Dick & Church pattern, and running at 150 revolutions per minute is rated at 150 nominal horsepower. The shaft is simply an extension of the engine shaft and is supported on standards from foundations laid under the floor. Three pulleys are placed on this shaft, from which belts are run to the three dynamos. A small pulley is also provided for belt running to a short counter shaft on the ceiling from which another belt is run to the pulley on the condenser.

The dynamos are the regular wood type of arc machines manufactured by the Fort Wayne Electric Co. Each of the three will supply current for 50 lamps at 6.8 amperes. The switch board is for three circuits and is the regular Fort Wayne pattern in which cables with plugs at either end are used for connecting the terminals of the dynamos to the circuit terminals. The condenser, made by the Conover M'f'g. Co., of New York is of the jet type and run by a belt from the engine shafted as stated above. A small plunger pump is attached to the side of the condenser and is used for feeding water to the boilers. As the condenser and pump are constantly in motion a by-pass pipe is provided for a free circulation of the water from the feed pump so that no power is consumed excepting when water is being fed to the boilers. The feed water is taken from a heater which is introduced between the exhaust of the low pressure cylinder of the engine and the condenser.

There are somewhat over 20 miles of street circuit of number six B. & S. gauge, strung on 30 foot chestnut poles. The 137 arc lamps used are nearly all hung from the center of cables crossing the street diagonally at their intersections. They are very well distributed and light the city completely. The station is lighted by series incandescent lamps on arc circuits, natural gas being used at such times as the dynamos are not running. The smoke from this gas has badly blackened the entire enterior of the station giving a very bad impression as to the care of the plant. The contract for the labor necessary to operate the plant is let to the chief engineer for a fixed sum each year. On the 21st of November, 1892, the city engineer submitted the following:

To the Mayor and Common Council:—**I hereby respectfully submit the following report of the cost of electric lights from December 1st, 1891 to November 16th, 1892.**

Coal	$ 705.50
Carbons	699.69
Oil	191.20
Globes	41.89
Waste	32.10
Packing	14.28
Incandescent lamps	62.52
Carbon holders	25.35
Gas	20.54
Cleaning and repairing dynamo	17.25
Repairs on lines	27.00
Insurance, estimated, not paid	143.75
Repairs on Machinery and grates	41.07
Sundries and supplies	108.67
Paid for operating	2525.00
Interest on bonds	1150.00
Total	$5805.81

135 Arc lamps to Oct. 1st.
137 Arc lamps since October 1st.
(Signed) George W. Jones.

In order to make comparsion of this report with that of the Topeka plant, in the June issue the above table of items has been rearranged as follows:

			PER CENT OF TOTAL.
Fuel		$ 705.50	14.7
Carbons		699.69	14.7
Globes		41.89	.9
Oil, waste, packing, 191.20; 32.10; 14.28		237.58	5.
Repairs, 62.52; 25.35; 17.25; 27.00; 41.07		173.19	3.6
Expenses, Insurance, Supplies 20.54; 143.75; 108.67		272.96	5.6
Superintendence, Labor, 135.00; 2525.00		2660.00	55.5
Total operating expense		$4790.81	100.
Taxes	$ 240		
Depreciation	2100		
Interest on bonds	1150	3490.00	
		$8280.81	

It will be noticed that this table includes three items not on the report as submitted viz: superintendence, taxes and depreciation. The first of these items is a part of the salary of the city engineer, he devotes a very small portion of his time to the electric lighting plant but it is however, under his immediate supervision. The second item, taxes, is figured at 2.4 percent on one-third the total value of $30,000 which according to our reports from that city is approximately correct and is the same as would have been paid to the city by a private plant. The third item, depreciation is calculated at seven percent on the total value of the plant, that being the average combined figures as used in Mr. Allen R. Foote's census office returns. The item of insurance is merely estimated, and has never been paid. All other items are taken directly from the report.

The output statement is as follows. The lamps are burned every night during the year and as long as in the opinion of the engineer in charge, the light is needed. It is quite accurately stated at 3,290 hours per year per lamp or a trifle over nine hours per night: Thus

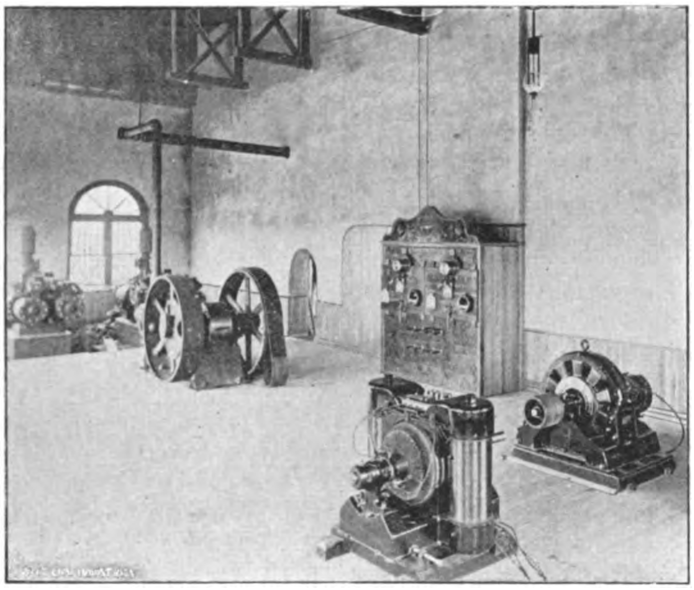
135 lamps for a full year less 14 nights	427.140, lamp hours.
2 lamps for 47 nights	846
Total arc lamp hours	427,986

The lamps are of the divided arc type and run at about, 48 volts and 6.8 amperes or 326 watts each. The total output in kilowatt hours is therefore 139,523.

The costs calculated from the above tables are as follows:

	OPERATING EXPENSE ONLY.	TOTAL, INCLUDING INTEREST, TAXES AND DEPRECIATION
Per lamp, per hour	.0112	.0194
Per lamp, per year	36.84	63.82
Per lamp, per month	3 07	5.32
Per kilowatt hour	.00344	.00594
Cost of fuel per lamp-hour	.00165	
Cost of fuel, per kilowatt-hour	.0,00505	
Cost of labor, per lamp-hour	.00621	
Cost of labor, per kilowatt-hour.	.01905	

While these costs as figured are very low there is reason to believe them correct. As the station is not old enough pet to have a heavy repair account it is safe not to assume these as the ultimate results. The regular and extraordinary repairs will somewhat increase as the plant grows in age, and from the condition of the building and of some of the lamps it might fairly be assumed that little attention was paid to cleanliness and the smaller repairs of apparatus.



A SOUTHERN LIGHTING PLANT.

The station was designed and equipped under the supervision of Mr. M. M. Skiff, a very capable mechanical engineer, who at the time was a member of the Board of Public Works of Jamestown, and is now connected with the Jamestown Plush Mills. The whole combination, consisting of very economical boilers, a compound condensing moderate speed engine, belted condenser and feed pump with heater for taking the remaining heat out of the exhaust steam is of the most approved pattern for this type of plant, and may well be considered one of the best yet installed.

A Southern Lighting Plant.

Probably no part of this country is marked by greater progress and improvement than certain sections of the South. All departments of business have grown during the past few years, and with the general prosperity has come the desire for modern conveniences and improvements.

Monroe, Louisiana, is one of these progressive towns of the South and has just secured a complete system of electric lights. The plant is owned and operated by a local company, the Monroe Water Works & Light Company. The streets, stores, halls, residences, etc., are lighted from this place. The station is a model of its kind and one of the finest in the South. It is supplied with nothing but the most modern machinery and apparatus which include everything of possible use in a central station. Its owners have received many compliments from visitors on the neat arrangement and equipment of the station.

The plant includes two 500-light incandescent dynamos, two 50-light arc dynamos, and was installed by the Standard Electric Company of Chicago, who received the entire contract for the plant including the erection of the outside circuits. The arc lamps, switch board and accessories are all of the well known Standard make. This company has earned a very high reputation as the manufacturer of electrical apparatus, and its exhibit at the World's Fair in constant use will show to the many visitors its points of superiority.

The accompanying engraving shows but a corner in the central station at Monroe, but sufficient to show the arrangement of the machines. It is light and well ventilated.

Meeting Northwestern Electrical Association.

The Northwestern Electrical Association meets at Madison, Wis., July 19 and 20. The following program has been prepared:

WEDNESDAY A. M.

Organization, and President's Address.

WEDNESDAY P. M,

Corliss Compound Engines..............E. L. Debell, Shebogan.
Russell Tandem Compound Engines................................
Gas Engines Applied to Electric Light Work...............
...............................Geo. A. Farwell, Waukesha.

WEDNESDAY EVENING.

Alternating Current Phenomena (with experiments)...........
...................................George Cutter, Chicago.
Economy in the Use of Meters..........Prof. Jackson, Madison.

THURSDAY A. M.

Management of Central Stations..............................
Average Charges and Methods of Charging of Northwestern
Central Stations.......................P. H. Korst, Racine.
The Business End of Electricity..........H. C. Thom, Madison.

THURSDAY P. M.

PLEASURE.

Meeting of the Association of Railway Telegraph Superintendents.

The annual meeting of the Association of Railway Telegraph Superintendents was held at the Plankinton House, Milwaukee, Tuesday and Wednesday, June 20th and 21st. The program arranged included, besides the regular business program, papers by Mr. J. W. Lattig, Mr. T. D. Lockwood of the American Bell Telephone Company, Mr. R. W. Adams of the Philadelphia & Reading R. R., and others.

Electric Power has recently changed owners, and now appears from the office of McIlroy & Emmett, of 36 Cortlandt St., New York, in whose hands we wish it success.

Electrical Industries.

Entered at Chicago Postoffice as second-class mail matter.

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E. E. WOOD, Secretary

EASTERN OFFICE, WORLD BUILDING, NEW YORK.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

In order that we might better serve the interests of our many readers, we began on June 15th the publication of a Weekly World's Fair Supplement. Our purpose in thus issuing a supplemental sheet has been both to supply our readers throughout this and other countries with the freshest and most complete news of everything of interest at the World's Fair, and give the visitor who comes to the great Exposition information not otherwise available. With the object of having something of real service and value to the visitor, we publish in the paper each week complete diagrams of the Electricity Building, giving the name and location of each exhibitor. These diagrams we have the satisfaction of knowing are highly appreciated, and used constantly by all electrical people at the Fair as an official directory. Another feature, and a most valuable one, is a map of the city of Chicago, giving the name and location of its electrical and allied business interests. Visitors, and especially those who are not familiar with the city, find this map of great service, and also use it constantly. Our enterprise has met with a more cordial reception than we had anticipated, and we are in receipt of words of approval from every part of the country, together with a large number of new subscribers. We are grateful for the appreciation shown, and take this opportunity to heartily thank all who have thus contributed to the success of our undertaking. We hope that our friends will be pleased with subsequent issues.

In this issue will be found a very complete statement of the expense of running the municipal lighting plant at Jamestown, N. Y., together with information in regard to the apparatus used in the power house, etc. Jamestown is to be congratulated on the results shown. The installation of good machines on good foundations is one of the first essential items in the successful operation of an electric lighting plant. It has too often happened that persons anxious to have electric lights have allowed a plant to be installed in the cheapest possible manner, thinking that the increased cost necessary to put in a good plant in a substantial manner would prevent the installation of any at all. It also often happens that a man is placed in charge whose only qualification is that he will work cheap, when the difference saved in the salary of the superintendent is lost many times over in the extra repairs and breakdowns. The cost of a good electrical engineer to superintend the purchase and installation of a plant is sure to be saved with a large percentage added in the better service secured.

Since the formal opening of the Electricity Building many improvements have been made, giving the building a more finished appearance. The large openings in the south end through which the railroad tracks originally ran have been closed and are being concealed by the workers in staff. The building will now compare favorably with any of the other buildings. It has become one of the great attractions of the Fair. The number of visitors especially at night, has been enormous.

The appointment of the jury of awards and the method to be employed in making the awards in the Department of Electricity is at present of the greatest interest to exhibitors. It is stated that the selection of the jury is now being made, the appointments to take place July 3rd, while the work of making awards will begin July 15th, and continue for two months. In the regulations governing the awards it is understood that sections 3 and 5 will be slightly modified, a matter which will be decided upon at once. From the great number of practical and theoretical electricians of the country we are sure that Chief Barrett and his department will succeed in selecting the best men available.

The windmill, one of the oldest forms of mechanical power, has been used successfully for grinding grain, pumping water and numerous other operations where a regular and constant power is not required. In the United States its use is confined almost entirely to pumping water for domestic use and irrigation. There has recently been several articles published on the use of the wind mill for driving dynamos, and a number of instances are reported where it has been successfully used. The chief difficulty that presents itself is the regulation of the speed of the dynamo, the velocity of the wind varying through so wide a range, and the storage of the current when the wind is not sufficient to run the dynamo. The cost of the apparatus, however, will doubtless preclude its use for anything but as an experiment.

THE VALUE OF WATER FALLS FOR ELECTRIC LIGHTING.

The value of water falls for power has greatly increased since the introduction of electric lighting and the perfection of electric transmission of power. That in the far West it is appreciated is shown by the number of power plants that have been recently installed. Falls in rough districts, totally unfit for the location of a town and almost inaccessible to railroads, are being utilized for the generation of electricity, which is transmitted to distant towns and cities. In the mining regions their value is also being appreciated. They are being developed, and the power used in the stamp mill or for the transportation of ore. In the New England States their value is recognized to such an extent the rights are sought by capitalists as investments. According to the Boston Traveler one concern has recently acquired for purely investment purposes forty-eight water right privileges in different sections of New England. Water power is one of the cheapest methods for the generation of electricity, and there are many towns that would be without electric lights were it not for their water power.

DESTRUCTION OF PIPES, CABLES, ETC., BY STREET RAILWAY CURRENTS.

An important problem has presented itself to the electrical engineers in connection with the operation of electric street railways. Complaints are made in a number of cities, and the same conditions will be probably found in many more upon investigations of the destruction of pipes in the vicinity of electric street railways using the earth return as a part of the circuit. The destruction is not confined to water pipes, but the electrolytic action of the escaping current causes the destruction of gas pipes, telephone and telegraph cables, and almost all underground iron work.

The amount of current necessary to accomplish these destructive results appears to be very small, so that although great improvement has been made in the methods of bonding in the more recently constructed roads, the defect has not been wholly remedied.

Even cables protected by tape, braid and asphaltum are affected by the electric current. The subject demands a thorough investigation, and methods will undoubtedly be devised for the prevention of the difficulty. The introduction of the double trolley would involve a large outlay, but would remedy this defect. As long as other means can be devised street railway men will not go to the extra expense of adopting that system. The opposition to the overhead trolley has been so great in certain sections that its introduction has been slow, and accomplished only by hard work. This defect in the present system will give the enemies of the overhead trolley a new argument which they will not be slow to use. The sooner some active measures are taken for the prevention of these injurious effects the better it will be for the electric street railway interests.

A New Discovery in Electric Heating.

In the Consul Reports for June is found a very interesting account from Consul General F. H. Mason, of the discovery by the two Belgian scientists, Messrs. Lagrange and Holio, of a process of electric heating. On applying for a patent the method seemed so simple that the patent-examiners demanded that before issuing a patent a full description and demonstration of the process should be made in their presence.

The matter was referred to an eminent and disinterested electrical expert at Berlin. The description of the process as given by Mr. Mason was derived from the process as tested by the expert at Berlin. The apparatus consists of a glass or porcelain vase which is provided with a lining of lead connected with a good electrical conductor. A pair of tongs with insulated handles is attached to the negative pole of an electrical generator. The vase is filled three-quarters full of water slightly acidified. With this simple arrangement the test of the process was made. After the current is turned on a bar of wrought iron is taken up by the tongs and the end plunged in the water in the vase. The water immediately begins to boil at the point of contact; the immersed portion of the bar rises quickly to a red and then to a white heat. The heat soon becomes so intense that the iron melts and falls off in bubbles and sparks. The heating has been so rapid that neither the tongs nor the end of the bar has become more than slightly warm. If the current be turned off and a stick of carbon be inserted in place of the bar of iron, the heat in a few minutes produces detached fragments of amorphous carbon.

The rapidity of heating and the limit of temperature are governed easily by the strength of the current employed. During the experiments in Berlin, the instruments registered 120 volts and 220 amperes and it was estimated that fully one-half of the energy was utilized in heat.

A simple explanation without entering into the technical part of the process is given as follows: One of the well known effects of electricity is to separate compound fluid bodies through which it passes into their primitive elements. The current passing through the water decomposes it into its two elements, oxygen and hydrogen. The oxygen is gathered on the large surface of the lead lining while the hydrogen collects around the end of the bar of iron, interposing a powerful resistance and thus the heat is developed that melts the iron bar.

It is too early to form any definite idea of the extent to which this new discovery may be applied. For welding it seems to present several advantages. The quickness with which the metal may be heated, the accurate regulation of the heat and the fact that the metal is clean and free from all foreign matter are points not possessed by the ordinary process.

At Essen, Krupp & Co. are experimenting with the process in the hardening of cannon and armor plates. Whether it can be used in the refinement of the various metals to advantage is a problem that will be soon undertaken.

The World's Congress of Electricians.

The World's Congress of Electricians that meets in Chicago in August, promises to be an interesting event. The response to the invitation for papers on appropriate subjects has been generous. It is desired that all papers be sent to Prof. T. C. Mendenhall, Washington, D. C., as early as the first of August to allow time for printing. Prof. H. S. Carhart, Ann Arbor, secretary of the Advisory Council, reports the following list of prominent electricians who have consented to read papers.

Mr. W. H. Preece, F.R.S., engineer in chief of the Post Office, London: "Signalling through space by means of the electromagnetic vibrations."

Prof. W. E. Ayrton, F.R.S., City and Guilds of London, Central Institute, London; "Variations of P.D. of the electric arc with current, thickness of carbons and distance apart."

Dr. Stephen Lindeck, Physikalisch-Technische Reichsaustalt, Berlin: "On materials for standards of electrical resistance and their construction."

Prof. S. P. Thompson, F.R.S. Finsbury Technical college, London: "Ocean Telephony."

Prof. Elihu Thomson has accepted the invitation of the committee to deliver one of the evening lectures which will be profusely illustrated.

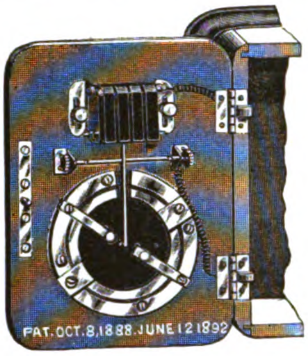
The Equipment of the Chicago & St. Louis Electric RailWay.

It is reported on the authority of an officer of the General Electric Company that it is to furnish the electrical equipment for the Chicago & St. Louis Electric Railway. The contract is said to have been taken on a strictly cash basis. The grading of this road is reported as progressing slowly on account of the general stringency of the mōney market. As soon as a sufficient portion of the line is completed trains will be placed on it.

The attendance at the World's Columbian Exposition for the month of June exceeded two and one-half millions of paid admissions, as against one million and fifty thousand for the month of May.

The D'Unger Telephone.

Among the different telephones that have been perfected and promise to come into use on the expiration of the fundamental Bell Telephone patent is the D'Unger telephone.



THE D'UNGER TRANSMITTER.

The instrument is well made and is in appearance very much like the ordinary Bell telephone. The most noticeable difference is the relative positions of the transmitter and the magnets which are exactly reversed. The workmanship is of an excellent order. The mechanism is simple, and not liable to get out of order and adjustment.

As shown in Fig. 1 to the back of the diaphragm is attached a small lever which is pivoted at its center through which electrical connection is made to the lever. The opposite end of the lever swings between the four carbon pencils. Resting against the vibrating plate or diaphragm are two small brackets which limit the vibration of the plate. These brackets hold set screws by which they can be adjusted. It is reported that the Chicago Twin Wire Long Distance Telephone Co. will use these telephones on the system for which they recently secured a valuable franchise in Chicago.

Mr. D'Unger the inventor of this telephone has spent a considerable time in experiment and investigation and has secured a number of patents on useful articles and instruments. His first patent on the telephone was secured in 1888, and several more recent patents cover the improvements in this telephone. It is said that the words are reproduced very clearly and distinctly, a result that is secured by the arrangement of the carbon pencils that cause the points to free themselves quickly. By the perfect adjustment of the bracket screws no running together of words is produced which is a defect often noticed.

The patents on this telephone are now owned by the D'Unger Long Distance Telephone Company by whom preparations are being made for the general sale of these instruments and their adoption by central exchanges.

Various Applications of Electric Heating.

The offices of the American Electric Heating Corporation at 274 Purchase St., Boston, Mass., on the 20th of last month, presented the appearance of a cooking school. The invitations sent out to numerous newspaper and well-known business men brought a large number of visitors to witness the practical demonstration of electrical heating in its various applications.

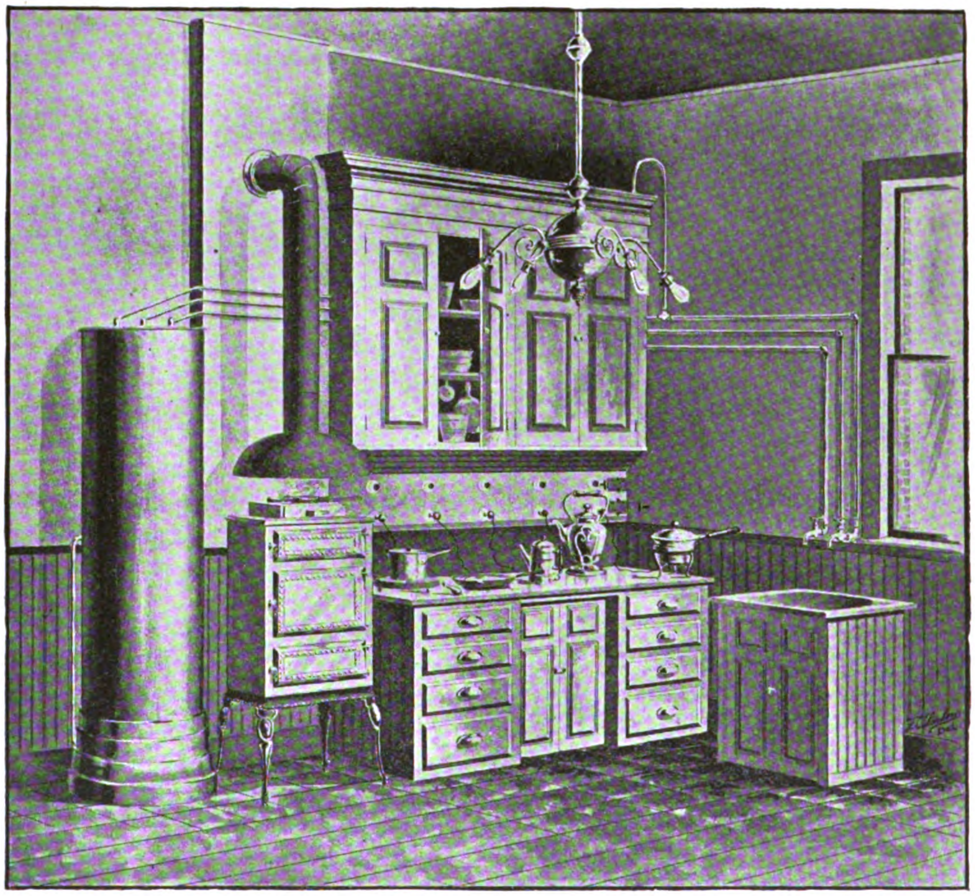


FIG. 1.—VARIOUS APPLICATIONS OF ELECTRIC HEATING.

After watching the process of preparing the dinner, the roasting, broiling, boiling, baking, etc., by the electrical apparatus under the direction of the cook, the visitors sat down to try the dinner thus prepared. The result was pronounced excellent; the even distribution of the heat was especially noticeable, and the cool rooms where the cooking was done caused many comments. The operation of the electrical radiators and heaters were shown for use in houses, cars, etc.

In the engraving Fig. 1 is shown a view of the arrangement of the culinary apparatus. The object in the center of the picture resembles very much a desk is really the range.

It is really nothing but a cupboard with a row of drawers and a slate top on which are placed the various cooking utensils, stew pans, coffee pots, pots for boiling vegetables, etc., are shown. Just above the wall is the switch board with sockets in which the plug connections are inserted. Each utensil has attached to it a flexible cord and plug which are removed from the socket when not in use. Above the switchboard is placed a cupboard in which is stored the various utensils when not in use. At the left of the range is the oven, in the two lower chambers of which baking and cooking is done, while in the upper, plates, etc., may be kept warm. On the top of this oven is placed the broiler, over which is a hood and ventilating pipe through which all fumes of the cooking are carried off. The hot water heater is shown at the left, in which the water is heated and conveyed to the sink at the right through the pipes as shown.

Thus it will be seen that the arrangement is such that the greatest neatness and convenience is secured. The position of the switchboard and the manner of connecting the different cooking utensils is such as to permit the most economical use of the current. In Fig. 2 is shown the method of heating by hot water circulation, the heating apparatus being enclosed in the upright cylinder in which the water is first heated, and thus circulating throughout the pipes heats the adjoining room. In Fig. 3 is shown the coffee or tea urn which is manufactured in several sizes, and is of convenient pattern for use in hotels, restaurants, etc. In the various applications of electricity for commercial heating are the following: tailors' machine irons, soldering irons, glue pots, jewelers' outfits, crucibles, muffles, etc. While the cost of the current exceeds that of coal, the heat can be applied direct, it can be more economically used, and the neatness and great convenience will probably at no distant day be found to offset the increase in cost.

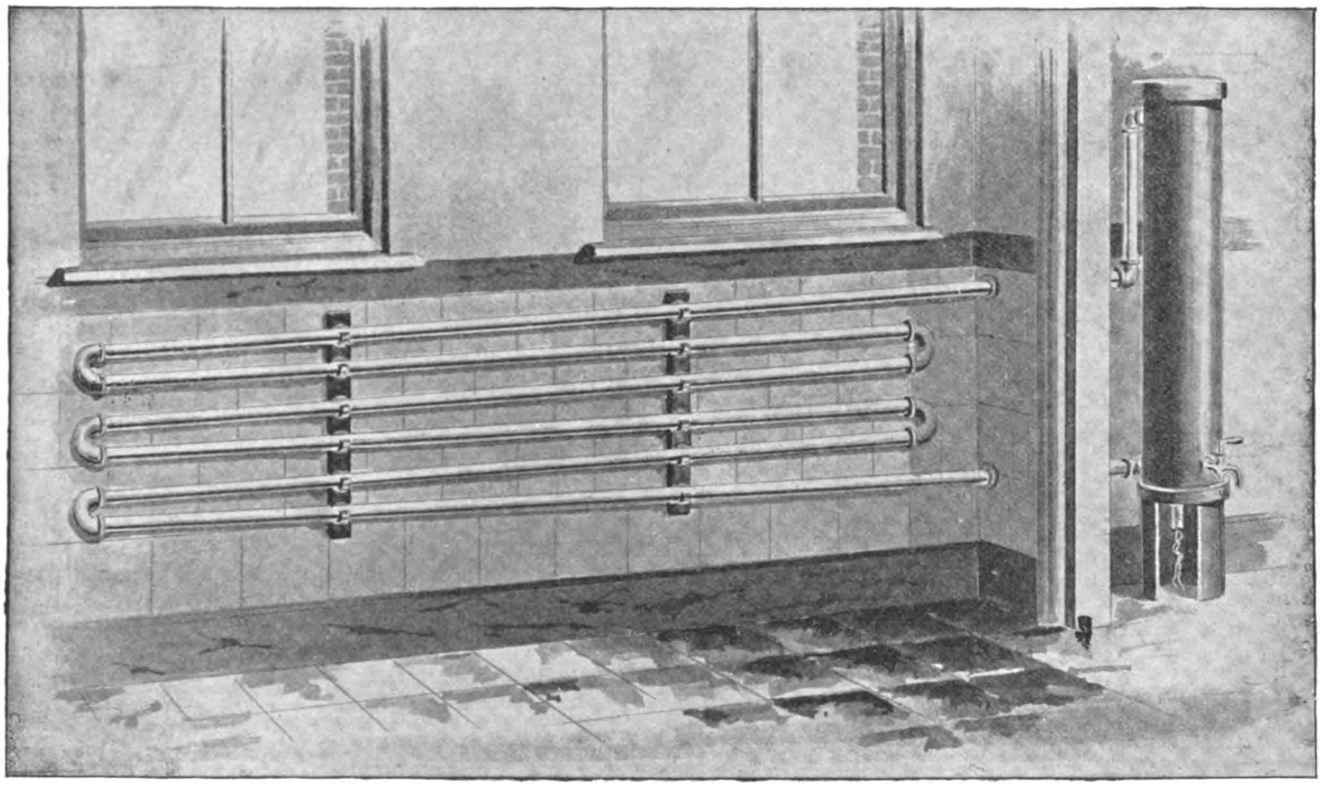
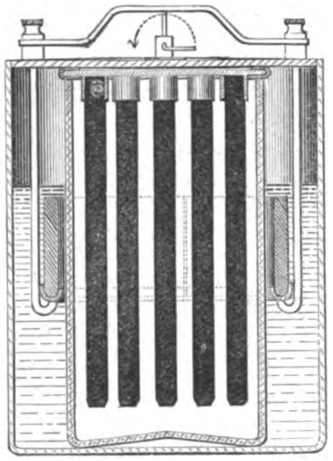


FIG. 2.—VARIOUS APPLICATIONS OF ELECTRIC HEATING.

The patents of these various devices numbering over 250 in all, are owned by the American Electric Heating Corporation, which is composed of a number of well-known eastern capitalists. The president is Mr. Edward Jewell; treasurer, Mr. Arthur B. Smith.

The New England Electrical Heating Company, with offices at 629 Atlantic ave., Boston, is introducing the system throughout New England and in the Middle States, the Central Electric Heating Company, of 26 Cortlandt St., New York. The corporation has a valuable list of patents, and is backed by an abundance of capital, so that it should succeed in this new field.



NEW ATLANTIC BATTERY.

New Atlantic Primary Battery.

A new primary battery, specially adapted for small machines, such as fan motors, sewing and dental machines phonographs, etc., has been placed on the market by the Electro-Chemical & Specialty Co., 136 Liberty St., New York. It is well made, compact, being six and one-half by seven by eight inches high, efficient and economical. The cell is constructed of india-rubber with a tightly-fitting cover. This cover is fitted with an arrangement for raising the zinc out of the solution without lifting the cover or disconnecting the wires.

The plate that supports the 18 carbons rests on the top of the porous cup, as illustrated in the accompanying cut. An improvement has been made in the constructions of the binding posts, so that they will not corrode. Its capacity is given at 150 ampere hours and 40 amperes at two volts on short circuits. It will maintain a constant E. M. F. during the life of the charge, and, when not in use, the zinc does not deteriorate. Any two-fluid carbon battery solutions may be used.

The company also manufacture a very efficient fan motor of a simple, yet entirely new design. It can be fitted with a pulley from which may be belted any small machine, such as sewing and dental machines, etc.

New Lang Switches.

In the accompanying cuts are shown two styles of the clipper switch manufactured by J. Lang & Co., 44 Michigan st., Chicago. In Fig. 1 is shown the double pole clipper switch, and in Fig. 2 the single pole quarter throw switch. The general style of the switches is illustrated in the cuts. The current is carried through the blade of the switches, and in no case through the arm. The blades are made of pure hard rolled copper well finished. The arrangement and mounting of the parts is done with special care, and the result is a switch by which the current is quickly and easily broken and contact as quickly made. They are made in sizes of 20, 50 and 100 amperes, and to carry 500 volts. The bases are well made and finished, and make the switch an ornament as well as a very efficient instrument. Up to the present year over 5,000 of this company's switches were in use, and the sales have continually increased. The Ansonia Electric Company, Michigan Ave. and Randolph St., Chicago, is agent for these switches.

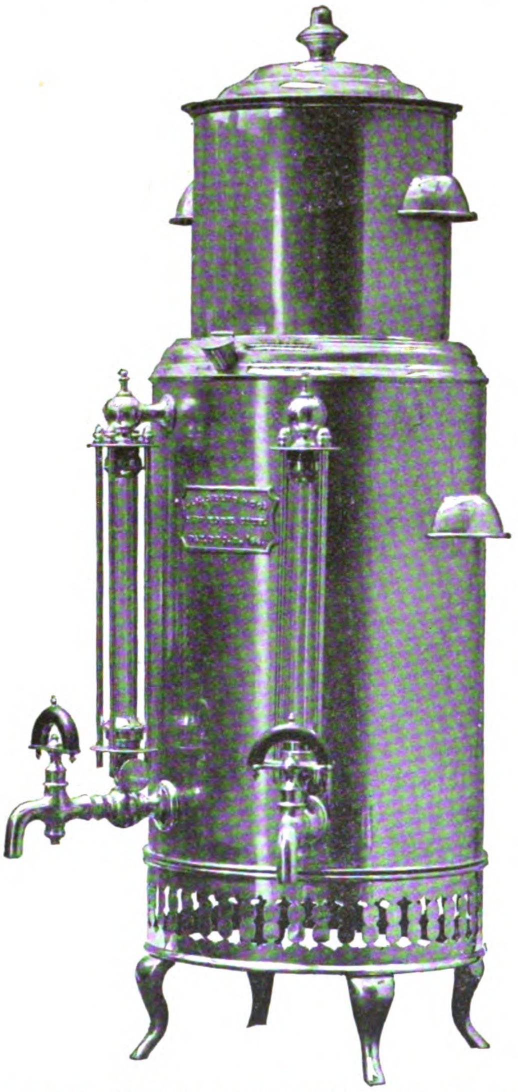


FIG. 3.—VARIOUS APPLICATIONS OF ELECTRIC HEATING.

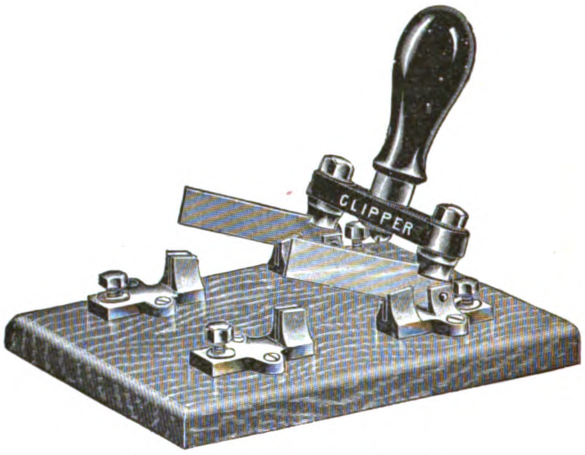


FIG. 1.—NEW LANG SWITCHES.

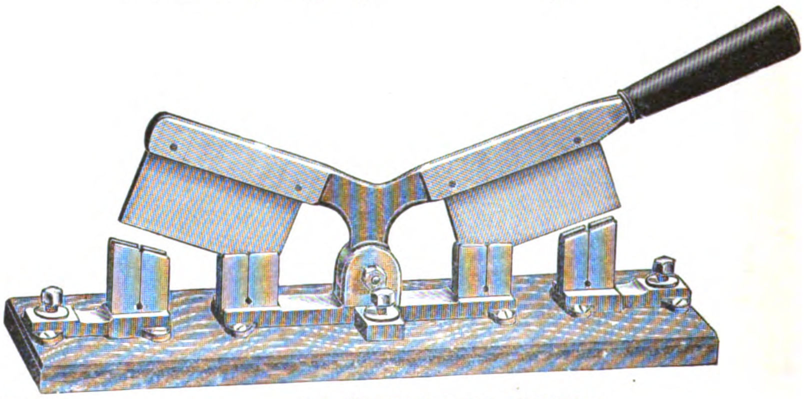


FIG. 2.—NEW LANG SWITCHES.

The Acme Portable Testing Set.

The rapid and correct measurement of resistance under varying conditions is an important factor in electrical engineering and for this purpose apparatus that will meet the requirements of practical work is highly essential. A very perfect commercial instrument is found in the Acme testing set illustrated and described herewith. The results of the long experience of the manufacturers have been embodied in this instrument. It is more compact, complete and convenient than their previous sets that have been great favorites.

It comprises a Wheatstone bridge, rheostat, D'Arsonval galvanometer, aluminum iodine battery and double contact key contained in a handsomely finished mahogany case, eight and a quarter by five and three-quarters by five inches in size. In Fig. 1 is shown the leather case which is very convenient when the instrument is used by inspecting engineers as it can be slung over the shoulder and carried, weighing less than six pounds complete, as readily as a hand bag. The coils in both bridge and rheostat are wound with platinoid wire, which is considered superior to German silver for this work and the adjustments are made with great care and exactness, an accuracy of one fifth of one per cent being guaranteed. The arrangement is similar to the post-office design with three coils in each bridge arm and 18 coils in the rheostat giving a total range by means of the reversing attachment of from .001 ohm to 11,110,000 ohms.

The galvanometer is a modified form of the D'Arsonval type made especially for this instrument and proves to be exceedingly sensitive and fulfills its work to a very exact degree. It is well made and strong so that it is not liable to injury with ordinary use and is so perfectly adjusted that readings can be taken very rapidly. It is not affected by magnetic fields or mechanical vibrations, and the instrument will give as accurate indications in the street, on shipboard or in a dynamo room as in a college laboratories. The battery is of the new aluminum iodine form with E. M. F. of one and four-tenths volts per cell or equivalent to a total of 17 volts, and should the battery be exhausted from long use, it can readily be removed from the box and renewed at slight expense.

The apparatus complete is shown in fig. 1, while figs. 2 and 3 indicate the arrangement of working parts. In fig. 2 A and B represent the two proportional bridge arms, B is the adjustable rheostat, and X the unknown resistance or line. In fig. 3 the arm A of fig. 2 is equivalent to the coils 1, 10, 100 on the left hand center row, and the arm B to the coils 10, 100, 1,000 on the right hand of same row. The rheostat R corresponds to the coils of the top and bottom rows, aggregating 11,110 ohms, and X the unknown quantity is connected between the two binding posts at the lower left hand corner.

In fig. 3 the blocks marked A, R, B and X are connected to the bridge arms and are the same as shown in the center of fig. 2. They constitute the reversing arrangement whereby the bridge arms may be interchanged and six coils be made to do the work of eight. Thus, when one plug is placed between A and R and another between X and B, the order of the arms working clockwise and beginning with R will be, R: X:: B: A. If the plugs are changed so as to connect A to X and R to B the order will be R: X:: A: B. By this means it also becomes possible to readily detect inaccuracies in the bridge ratios should any exist, and to eliminate them entirely in work. Thus, if the two 100 ohm coils of the proportional arms are slightly different, this fact becomes evident in practice by reversing and balancing them. If with a given unknown resistance the resistance in the rheostat has a different value in one case than in the other, the two bridge coils must be slightly different and the correct value of the unknown will be the mean of the two rheostat resistances used in obtaining the two balances.

The instrument is remarkably simple to operate, any lineman may in a short time be instructed so that he can use the set. Persons accustomed to the old forms of testing sets will immediately notice the difference between this small, compact case and two large boxes, one holding the battery and the other the bridge.

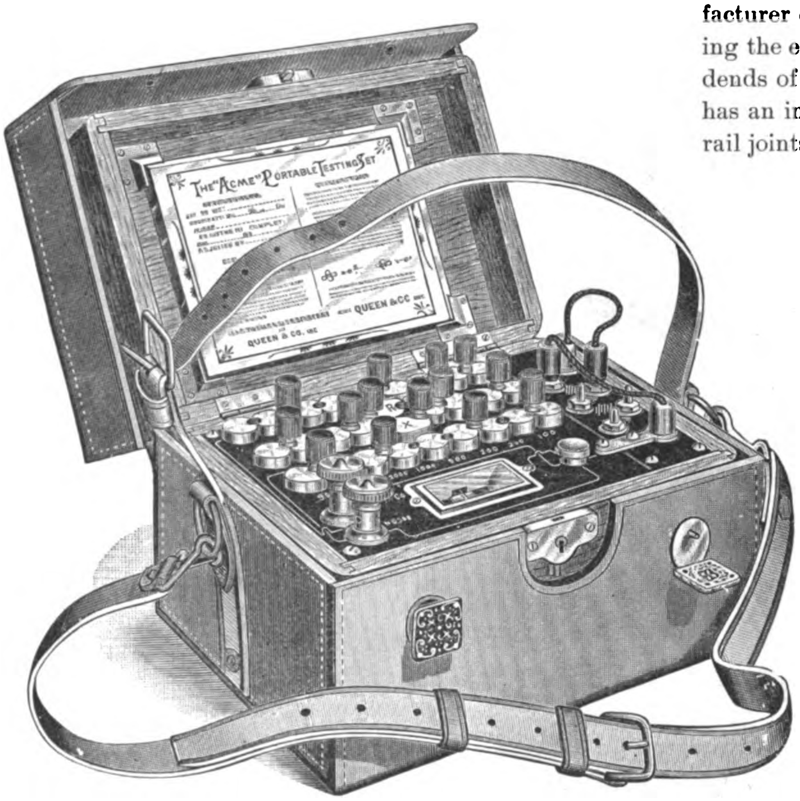


FIG. 1.

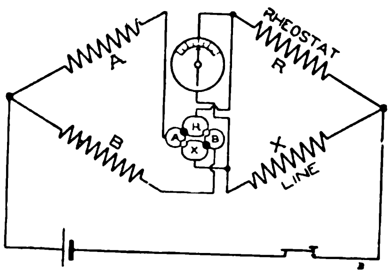


FIG. 2.

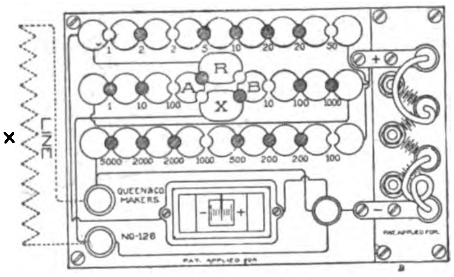


FIG. 3.

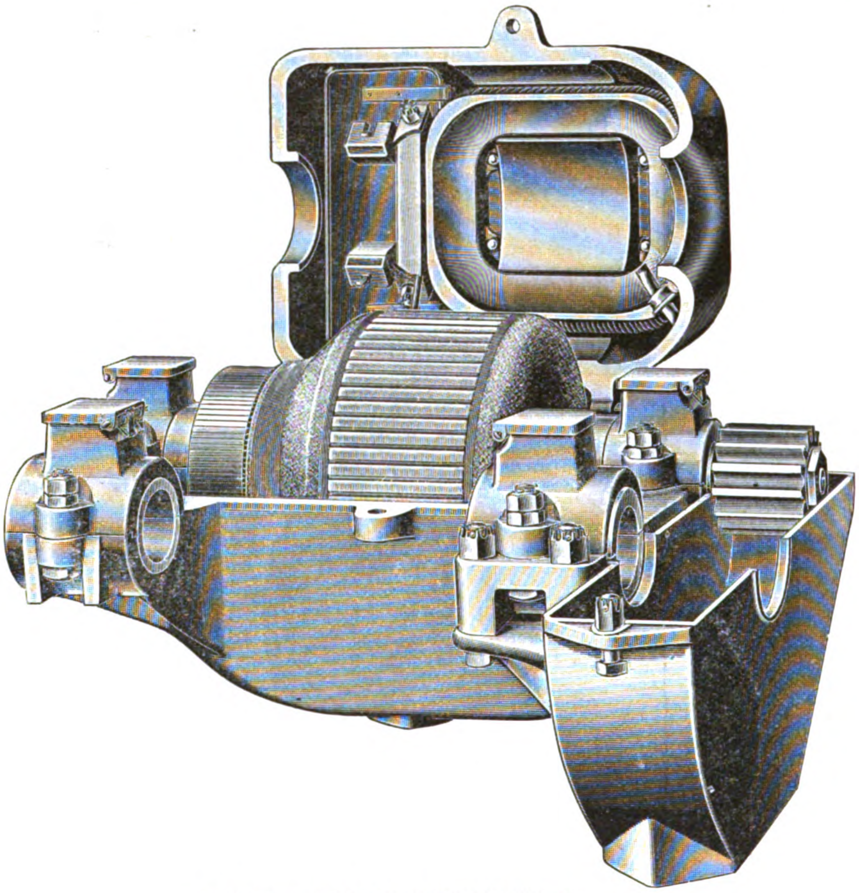
THE ACME PORTABLE TESTING SET.

The New General Electric Motor.

Not the least of the defects found in street railway motors is that of great weight which was especially true of the earlier forms of motors. Every pound by which the manufacturer can reduce the weight of his motor without decreasing the efficiency, in the same ratio he will increase the dividends of the roads using his motors, as any excess of weight has an immediate effect on the track, and especially at the rail joints which require constant attention.

In the new motor, known as G. E. 800, which the General Electric Company has recently placed on the market, a number of improvements have been made, among which is the attainment of the required efficiency while employing the least amount of material, and the elimination of a number of defects previously found in railway motors. The number 800 has been given to the motor as indicating its ability to exert a horizontal effort of 800 pounds through a 33-inch wheel continuously in ordinary street car service. It is rated as a 25-horse power motor, though possessing a much greater efficiency. It is a four pole motor of new design. In its construction the reduction of weight has been studied with considerable care with a view of meeting the demands of the growing street railway business. It is much lighter than the 15-horse power motor formerly manufactured by the General company, not less than 600 pounds lighter than the old S. R. G. 15-horse power motor, and two or three hundred pounds lighter than the W. P. 15-horse power motor.

In suspending the motor on the cross frame of the truck it will be so hung that only 500 pounds of its weight will bear directly on the axle. The working parts are easily accessible and when the aperture used for inspecting and cleansing the motor is closed the different parts, brushes, commutators, armature and field coils are so well protected that the motor could be immersed in water without injuring them. This feature will be appreciated by those who have had experience in the running of electric cars. These motors will not be affected by the changes of the weather. The closing of the motor in a tight case has been made possible by the use of the best grade of material and improved design of all the parts so that it runs much cooler than previous motors. It can be taken apart with the greatest facility. The top part is hinged on the lower, and with its proper parts weighs only 350 pounds. On the removal of the two bolts with which it is fastened it may be lifted entirely out of the way of the armature. The armature is short and can be lifted through an ordinary trap door. Thus the motor can be handled from within or outside of the car with almost equal facilities.



THE NEW GENERAL ELECTRIC MOTOR.

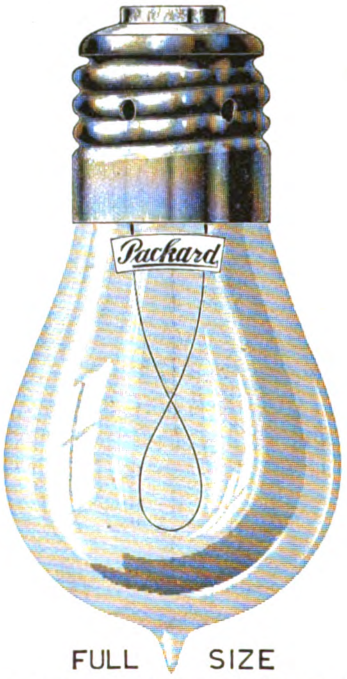
The armature is similar to that used on the W. P. motors, and is made both in the Gramme ring armature and the drum form. The drum winding has been carefully studied with a view to eliminating all former defects. A thorough trial has demonstrated the reliability of drum windings of this motor. The Gramme and drum armatures are interchangeable. The General company believes that in this motor it has been able to do away with not only the ordinary defects, but those that are apparent only under extraordinary conditions.

The Packard Six Candle Power Lamp.

Appreciating the demand for a small lamp for ornamental, advertising and special purposes that will compare favorably with the regular 16-candle power commercial lamps in efficiency and life, the New York & Ohio Company, the manufacturers of the Pachard lamps are placing upon the market something new in the 6-candle power lamp represented by the above cut. The lamp is similar in every respect to their regular commercial lamp, and has approximately the same efficiency and life.

The lamp is mounted to fit any standard socket and any of the regular low voltages such as 50 or 52 volt. Where they are burned on a higher voltage they should be wired two in series. The special feature which recommends the lamp is the fact that the filament is burned at the same degree of incandescence as that of a regular lamp, thus giving a uniform life and light. The advantage of a lamp of this kind for special purposes will be appreciated by any one who has been compelled to use miniature lamps for such purposes.

The Electric Appliance Company is the western agent for the New York & Ohio Company, and is furnishing these lamps in the west. A thorough test of the lamp is being made in the company's World's Fair exhibit, where there are over five hundred burning in the illuminated lamp sign. The effect produced by their use in this particular case gives some idea of the extensive field they will undoubtedly fill.

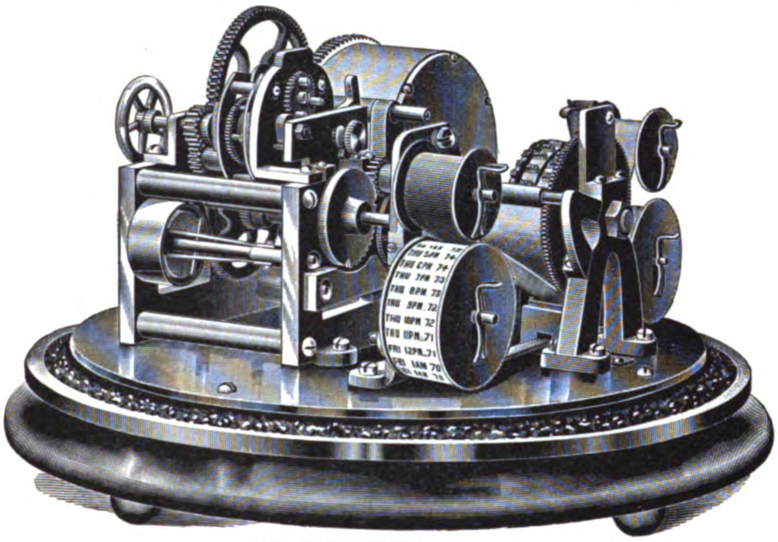


THE PACKARD SIX CANDLE POWER LAMP.

The Telemeter.

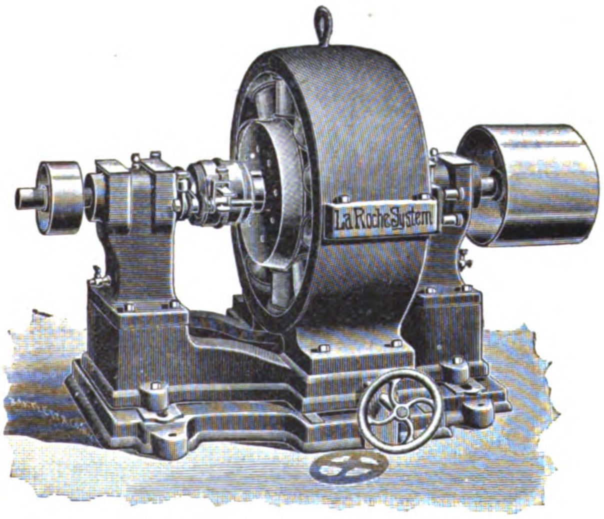
In the accompanying cut is shown the mechanism of the telemeter, a recent invention for recording the temperature. It is especially designed for use in storage rooms, warehouses, cars or in any place where a continuous record of the temperature is desired.

It is of great advantage to shippers of dressed meats, fruit or vegetables in cold storage as the temperature is recorded every half hour or hour as desired and for any length of time up to six weeks, and requires no attention during that time. The day of the week and time of the day is printed in plain Roman characters on a paper ribbon as shown in the cut. This ribbon may be attached to the bill of lading by the receiver of the goods and any neglect on the part of the carrier or carriers may be accurately fixed. This is of great importance where goods are shipped long distances and pass over a number of different roads. The application of the same principle in the temperature spear affords an instrument by which the grain in large bins in elevators or in boats may be inspected. These spears may be permanently fixed in elevators and connected to the office by wires where any evidence of heating will be easily detected by inspecting the recording instrument.



THE TELEMETER.

The Todd, Applegate Co., 340 Dearborn street, Chicago, are the patentees and manufacturers of the telemeter. It is enclosed in a neat and substantial box securely locked. They are placed in cars by the trip or on a monthly rental and legible work is assured. In cold storage warehouses, elevators, etc., they are placed at a yearly rental.



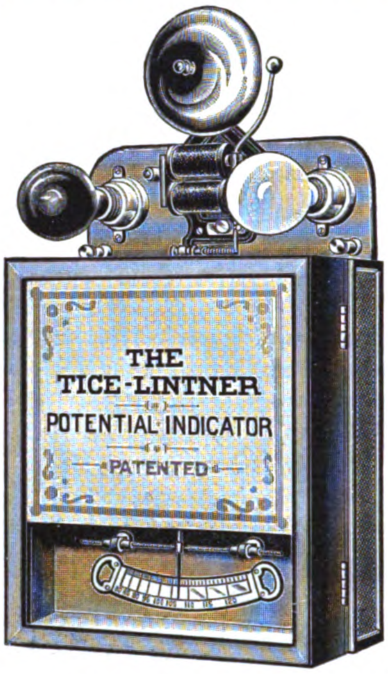
LA ROCHE NEW ALTERNATING DYNAMO.

The Todd, Applegate steam pressure recorder is a slight modification of the above instrument. It makes an accurate and complete record of the steam pressure of the boiler.

The Tice-Lintner Potential Indicator.

In the accompanying cut is shown the improved form of the Tice-Lintner potential indicator as recently placed on on the market. It contains a number of improvements that tend to make it an almost perfect instrument. The indicator combines with a volt meter of a high degree of accuracy, an alarm attachment which immediately attracts the attention of the attendant to any change or variation of pressure, and the same is remedied before any damage ensues to the lamps or motors on the circuit.

It is claimed that with an indicator the life of the lamps is greatly prolonged, since by its use the tension of the current is maintained more uniform. Aside from the alarm feature the especial features of the instrument are the entire lack of permanent magnets, or any other deteriorating element, and the fact that it can be operated in the close vicinity of intense magnetic fields without disturbing the accuracy of its readings. A neat circular is now being issued containing a complete description of the instrument. The manufacturer of the instruments is the Tice-Lintner Electric Company, Minneapolis, Minn.



THE TICE-LINTNER POTENTIAL INDICATOR.

La Roche New Alternating Dynamo.

A new alternating current dynamo made in both the exciting and non-exciting type, the latter of which is shown in the accompanying illustration, has recently been introduced by the La Roche Electrical Works of Philadelphia. They are made in sizes ranging from 25 to 3,000 lights. The machines from 25 to 500 lights are arranged with ten poles and run at 1,600 revolutions, thereby giving a frequency of 16,000 per minute. The larger machines have more poles but revolve at a lower speed which gives them the same frequency. The most modern ideas have been incorporated in them. All parts are inter-changeable. They are fitted with self oiling bearings and automatic overflow. The brush holders are of new design so made as to permit of any degree of tension. No commutator being necessary, two collector rings of especially hardened copper are used well insulated with mica. The fields may be removed for repair or inspection without interfering with the rest of the dynamo. The replacing of a field, on account of the peculiar construction, requires but a few minutes. The armature is built of the best laminated charcoal iron well protected. The core is mounted on two of the La Roche latest bronze spiders well secured to the polished steel shaft. The armature coils are wound separately and secured by an improved method so that they may be replaced by any intelligent person in a few minutes.

The system of winding the armature employed is such that the difference of potential between coils does not exceed 200 volts, and these coils are insulated from the core by mica coverings. The results of several tests show an even regulation and good efficiency. These machines are fitted with a cast-iron sub base well secured and mounted so that a special foundation is not required. Alternators of this style manufactured by the La Roche Works have been placed with a number of well known firms, among which are Messrs. Queen & Co., the Helios Electric Co. of Philadelphia, and the University of Wisconsin.

Some Applications of the Meston Alternating Motors.

In its use as a fan motor the Meston alternating Current Motor is well known. Recently the Emerson Electric Manufacturing Company, the manufacturers of the Meston motors, has been perfecting several applications of the motors in driving dental outfits, sewing and other machines.

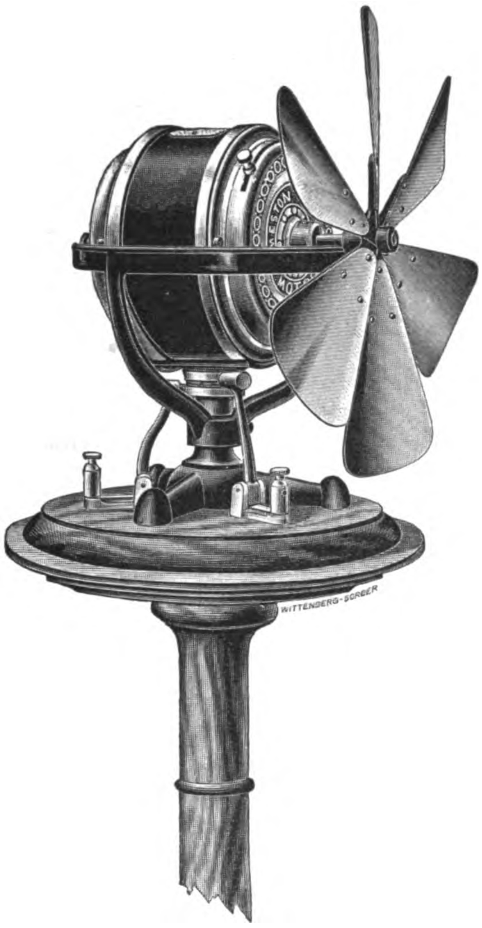


FIG. 1.—MESTON ROTARY FAN MOTOR.

Several years have been spent in the development of the dental outfit, and the result of this extended experience is now offered to the trade, a complete machine and guaranteed to give entire satisfaction. The whole outfit weighs complete about 30 pounds. The motor gives a speed variable at will by a slight pressure of the foot lever from 150 to 2,500 turns per minute, and can be instantly stopped or reversed. The stop brake acts mechanically, and when applied, automatically cuts off the supply of electricity, avoiding any waste of current and danger of burning field coils. The standard may be adjusted to any height, and is in fact complete in every detail.

A practical sewing machine motor has been brought out for use on alternating currents. The motor is arranged on a special base by means of which it may be clamped to any machine. It is adjusted to the treadle so that it is regulated, started and stopped by a slight pressure of the foot. It can be run at any desired speed between 30 and 1,500 stitches per minute, and can be stopped instantly, being provided with an automatic break.

Something new in fan motors are constructed in the new revolving fan motor. By an ingenious mechanical device attached to the regular motor it is made to revolve 20 or 25 times a minute, throwing a mild breeze in all directions. It is particularly adapted for offices and small stores, and when mounted on a pedestal makes a neat and attractive ornament.

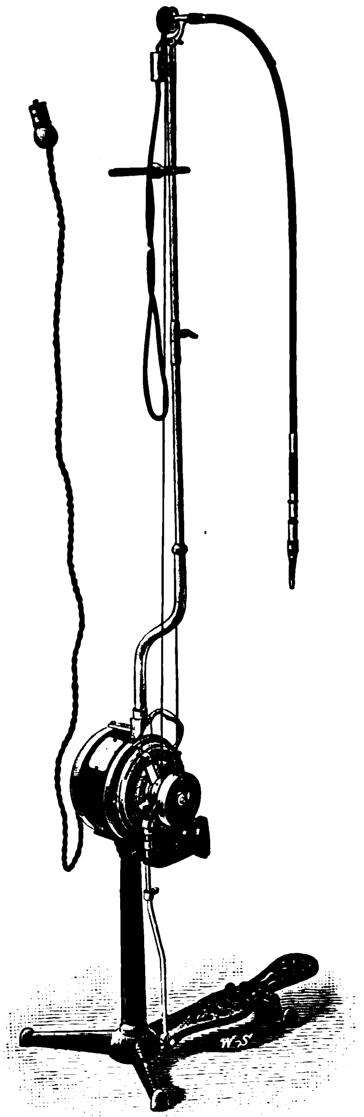


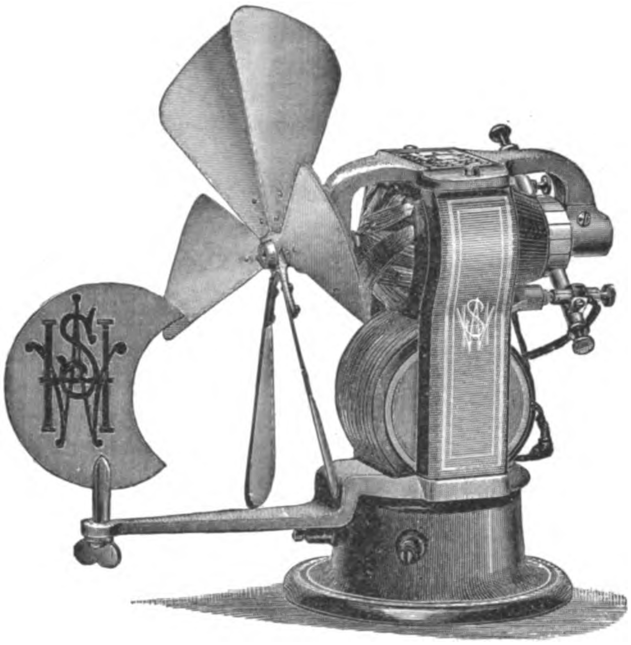
FIG. 2.—MESTON DENTAL OUTFIT.

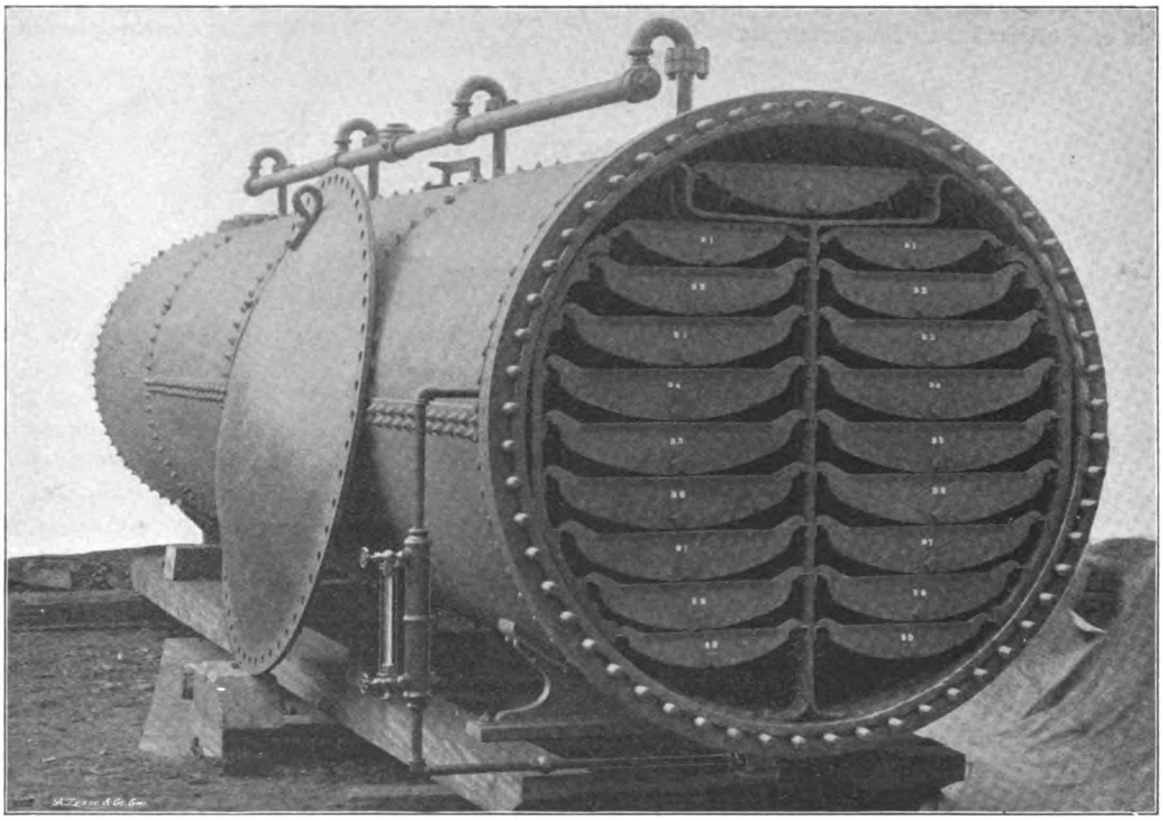
The Electric Appliance Company, 242 Madison St., Chicago, is the general western agent for these outfits.

Rotating Fan Motor.

There has recently been placed on the market by the W. S. Hill Electric Company of Boston, Mass., a fan motor that possesses an exceedingly novel method of producing the rotation of the motor. The outfit has been produced after months of experiments and is in all respects a high class machine.

The first noticeable feature is the crescent shaped rudder that is attached to the base of the motor and revolves with it. By placing this rudder at an acute or obtuse angle to the direction of the breeze the motor is made to revolve by the impact of the air on the rudder. The rate of revolution is regulated by the angle of the rudder. By placing the rudder at right angles to the fan it can be used as a stationary fan motor. This method of rotating and of modifying the rotation of the fan is certainly ingenious. The motor weighs about 20 pounds and runs a 12-inch fan at about 15,000 revolutions per minute and requires less than one ampere on a 110-volt circuit. It is practically noiseless in operotion. It is self lubricating and requires no attention. The bearings are cool being of high grade material. The rotating fan moter has the great advantage in small stores of distributing the breeze equally in all directions without creating a draft in one direction while other parts of the room are almost unaffected.


ROTATING FAN MOTOR.


A LARGE LIVE STEAM FEED WATER PURIFIER.

A Large Live Steam Feed Water Purifier.

In the accompanying engraving is shown a feed water purifier of 1,000-horse power capacity, manufactured by the Hoppes Manufacturing Co., of Springfield, Ohio. The Hoppes' purifiers are well known to steam users, having been on the market for a number of years, but the manufacture of purifiers of 1,000-horse power and upwards has been more recently undertaken by this company.

Purifiers of this size have been ordered for a number of power houses,being used in preference to several smaller ones. Its size may be better understood from its dimensions which are 68 inches in diameter and 26 feet in length. In constructing a machine of this large size that would be compelled to carry the full boiler pressure, the manufacturers found it necessary to construct it practically all of steel. The shell proper is made from the best of boiler shell steel, while the front and back heads are made from flange steel pressed into the required shape while hot by hydraulic machinery. The method of riveting is well illustrated in the engraving which shows something of the substantial manner in which they are constructed.

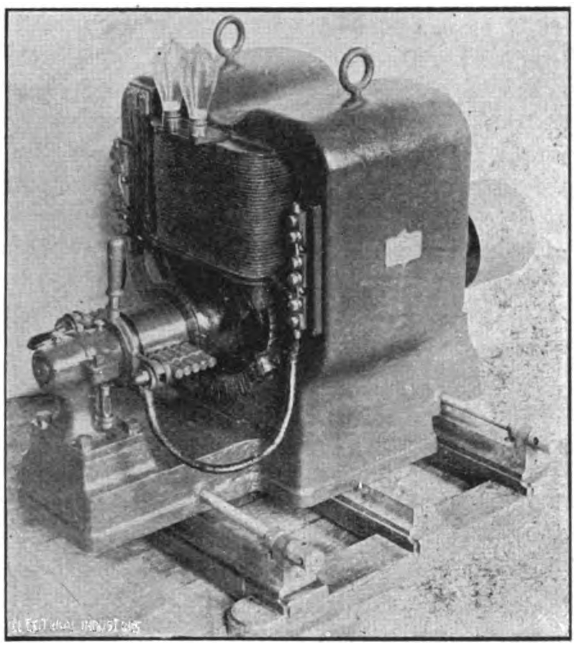
The use of feed water purifiers has become so general that specifications for them are looked upon as part of the contract for a power plant. A number of orders have been received from prominent steam users for purifiers of the above described diameter signifying something of the efficiency of these purifiers.

The Hoppes company has always given its attention to live steam feed water purifiers, and exhaust steam feed water heaters, and is among the best known makers of this style of machines. The location of the factory gives them good shipping facilities, and being centrally located it is in immediate communication with all parts of the country.

The Enterprise Electric Company, Chicago, reports very brisk trade in fan and power motors. N. I. R. wire, which the company is agent for, is in good demand, and the capacity of the factory is now being doubled in order to take care of its rapidly increasing business.

The Muncie Electrical Works Iron Clad Motor.

The Muncie Electrical Works located at Muncie, Indiana, has adopted the style of motor shown in the accompanying engraving as the standard for incandescent dynamos and stationary motors. As will be seen from the engraving it has but one field coil, placed above the armature which brings the center of gravity very low and consequently gives a form the least liable to vibration and its consequent injurious effects.

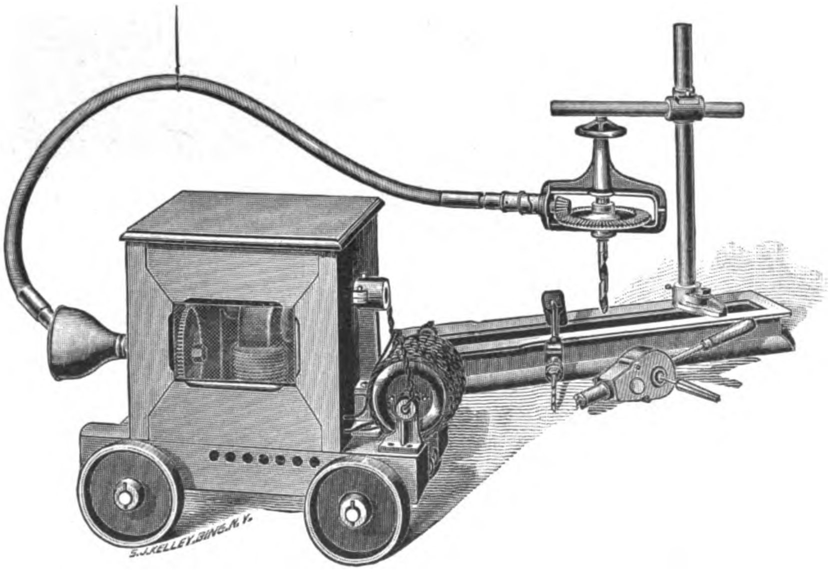

THE MUNCIE ELECTRICAL WORKS IRON CLAD MOTOR.

The field coil is in three sections so that but a part is liable to injury in case of accident. This arrangement admits of an easier removal for repair or inspection. The magnet frame is in one complete casting thus doing away with all joints and the breaks in the circuit. The armature is mounted on a shaft of extra large size and of the best grade of steel and is consequently exceedingly rigid. The core is of the highest grade of iron and of very low resistance. It is drum wound. The commutator is of fine tempered copper insulated by the best grade of mica. The brush holders are of new design fitted with the necessary adjustments for either carbon or copper brushes. The method of attachment is so simple that the holder may be taken off or a separate brush with little trouble.

The boxes are fitted with phosphor-bronz bearings, self-oiling and furnished with sight oil gauges. All the machines are slow speed with a pulley of large diameter giving an increased belt surface. The power generators and motors are built for 110, 220 and 500 volt currents. The best of material and workmanship are used in their construction. The officers of the company are experienced electrical men. Mr. F. C. Field the electrical engineer was connected with the General Electric Company for five years and also the Detroit Electrical Works. The facilities for the manufacture of incandescent and arc dynamos, power generators and motors for railway and stationary work are said to be excellent.

Stow Flexible Shaft and Electric Motor.

In the accompanying cut is shown a portable electric motor with flexible shaft fitted for drilling, tapping and reaming as designed and manufactured by the Stow Manufacturing Company, of Binghamton, N. Y. The Stow flexible shaft is well known to the trade as it is regarded as a standard tool, having been placed on the market some years ago, and, at the present time, is in general use. Recently there has been a tendency in the larger shops to increase the range of this tool beyond that for which it was originally intended. This demand has been met from time to time by increasing the length of the driving rope, and adding extra idlers for the support of same, but the objection has been raised that where traveling cranes and other overhead machinery are used, that the driving rope was in the way. These objections have been successfully overcome by the introduction of this specially designed slow speed motor, which has a normal speed of 600 revolution, but capable of being increased to 1,000, or, if desired, reduced by gears to 275 revolutions. These motors are wound for 110, 220 and 500 volt currents. The great convenience of this outfit is readily seen, and its many features adapting it for use in machine shops, especially where large and heavy machiney is handled, will be appreciated.

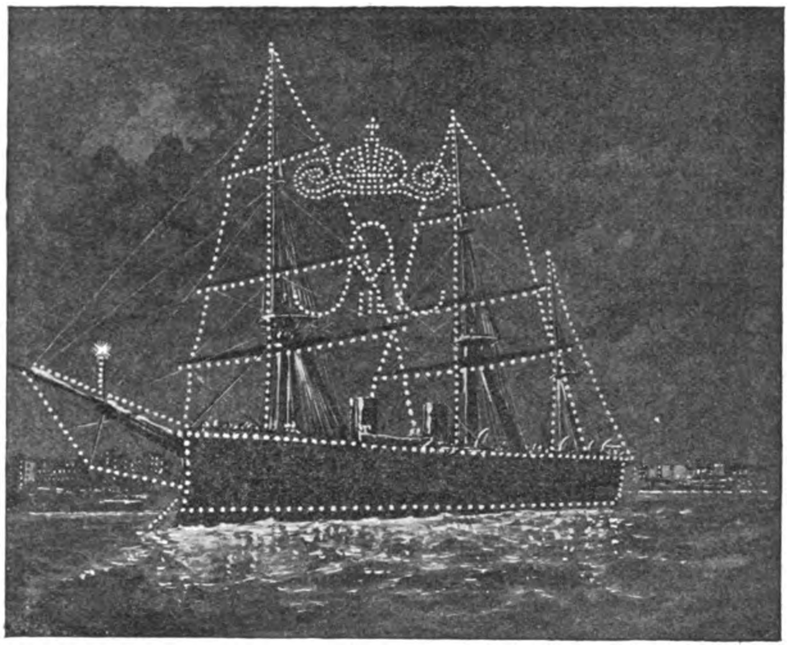

S.J.KELLEY,BING.N.Y.
STOW FLEXIBLE SHAFT AND ELECTRIC MOTOR.

The general Committee of Engineering Societies announces informal gatherings at the rooms of the Associated Engineering Societies, 10 Van Buren St., every Monday evening from 8 to 10 o'clock.

The Electric Illumination of the Dmitri Donskoi.

The decorative illumination of war vessels by means of small incandescent lamps was a new feature introduced with great effect during the recent Columbian Celebrations in New York, and the beautiful scene at night when the vessels were outlined in light against the black background of the night was not the least attractive part of the famous naval display.

The occasion of the birthday of the Czarewitch gave the Russian Admiral a chance to distinguish himself, and offer to the expectant public a view of his vessels at once beautiful and effective. The cut gives some idea of the illumination of the Dmitri Donskoi. The vessel was outlined in lamps from truck to water line, while between the masts was suspended a brilliant reproduction of the initial letter of the reigning Romanoff's name surmounted by the Russian imperial crown formed of scintillating lamps of different colors. In the position on the bowsprit usually occupied by the Jack, gleaned a small bright star. The Rynda's decorations consisted of the crossed Russian Naval and American flags surmounted by a five point star.



THE ELECTRIC ILLUMINATION OF THE DMITRI DONSKOI.

The work was done by the lamp department of the General Electric Company, under the immediate supervision of Messrs. G. C. Baillard and C. A. Gundaker, while Lieut. André de Pekrowsky of the Dmitri Donskoi, himself a skilled electrician, lent valuable aid in effecting the installation.

Correcting a Typographical Error.

Editor Electrical Industries: In the current number of your publication I notice an article on electric heating and cooking, by S. B. Jenkins, and I would like to make an inquiry as to section four in the second column of page 198, which states that "in round numbers, electricity at $0.15 per horse power hour or $60.00 per horse power year of 4,000 hours, etc." According to our mode of reckoning, 4,000 horse-powers at 15 cents per horse power hour would be $600.00 instead of $60.00 per year, as stated; and even at 5 cents per horse-power hour (the lowest rate quoted in the article) 4,000 horse-power hours would amount to $200,-00.

The only way in which I can explain it to my satisfaction is on the supposition that the error is in the position of the decimal point, and that $0.015 is meant, but this seems very low indeed for electrical energy, it being at the rate of only 2 cents per M watts.

Please have the kindness to set me right on the subject, and greatly oblige, Very truly yours.

Henry B. Holmes,
Springfield Electric Co.

Springfield, Vt., June 6, 1893.

The above letter has been received in reference to a typographical error which occurred in our June issue. The decimal point as Mr. Holmes suggests should have been on the other side of the cipher, making .015 instead of 0.15. His suggestion that this price, amounting to about 2 cents per thousand watts is low, is certainly timely and a fuller discussion of the cost of current should be taken up. Perhaps a letter from Jenkins stating the basis he has used for his estimates together with such details as he may have will clear the matter somewhat. The price as stated is very low to include all expense and it is possible that it would have to be increased very much to cover the average actual cost. In a first class station, recently examined, the cost of power came nearer 10 cents per thousand watts than to two cents. Ed.

Report of the First Municipal Electric Lighting Plant in Connecticut.

Editor Electrical Industries:

Replying to yours of the 16th, our electrical plant still remains as when started up on the 13th of last October, except that a few lamps have been added. The equipment consists of one 125-horse power horizontal tubular boiler, one 100-horse power "Ideal" high speed automatic engine, and two 60-light arc dynamos of the Western Electric Company's type. We have 96 arc lamps in service at present, which can be burned at either 1,200, 1,600 or 2,000-candle power each.

We have applied for a special charter allowing the city to furnish and sell commercial arc and incandescent lights. but it will be some time before the petition will be granted, The station which is fire-proof is built for double its present capacity, and also contains the city fire alarm telegraph service apparatus, also in charge of the board of electric light commissioners. At present only arc lamps for street lighting are supplied.

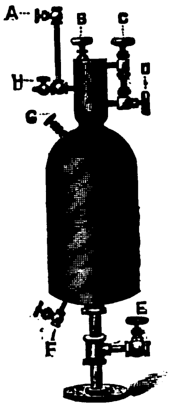
This is the first and only electric light system owned by a municipality in this state, and it has been a splendid success ever since the start.

The regular arrival of your journal always receives a hearty welcome in our office, and is looked to by our men as authority. Any further information that we can afford you will be gladly given at any time.

Respectfully,
A. E. Winchester,
Supt. City Electric Works.
South Norwalk, Conn., May 22, 1893.

A Boiler Compound Injector.

The use of boiler compounds for cleansing and purifying the water in boilers and preventing the formation of scale has become quite general among engineers. The economic and most beneficial use of the compounds depends largely on the manner and way in which it is introduced into the boiler. The L. Blatz Brass Works, of 105 West Monroe street, Chicago, manufacture a boiler compound injector, by the use of which the compound is introduced gradually with the feed water, which is said to give much better results than the methods formerly employed, especially from an economical standpoint.



A BOILER COMPOUND INJECTOR.

This injector is shown in the accompanying cut and its operation is as follows: Above the tank, which holds about three gallons, is a brass oil trap with a sight tube attachment. The valves A and E are respectively connected with the discharge pipe and suction pipe of feed pump. The tank is filled through plug G. Water is forced by the feed pump through valve A, and passing through the sight tube forces the boiler compound through valve E into the boiler. The amount of water which enters is regulated by means of the sight tube valves C and D. When the boiler compound has been replaced by the water from which it separates, being heavier, the water is drawn off through valve F and the tank refilled. The apparatus requires no attention after refilling. By means of this injector the boiler compound can be introduced gradually into the boiler, becomes thoroughly mixed with the feed water, and, it is claimed, will save from 25 to 50 per cent of the solution otherwise necessary.

A BRIEF REVIEW.

Although a large number of experiments have been made in the endeavor to discover what effect magnets and electricity have on the human body probably the most thorough and complete series of experiments was conducted by Dr. Frederick Peterson and Mr. A. E. Kennelly. These experiments were recently described in the New York Sun. They were moved to make these experiments by the reports of the experiments in physical magnetism, of Charcot, in Paris,and those of several German investigations to test the possibility of curing fits and other nervous disorders by electricity or magnetism. They were also interested to find out whether there was not at the root of hypnotism and hypnotic experiments a force somewhat of the nature of an electrical current which came from the operator and afflicted the will power and nervous organism of the subject. Without going into the theory Dr. Peterson and Mr. Kennelly conducted a series of experiments which extended over a considerable time to observe the effects of magnets and electric currents on the human system. They instance the belief of certain French and German specialists that electricity and magnetism have effects on the human organism, and that certain forms of hysteria are better treated by the magnet than by drugs, claiming that a magnet increases the resistance to conduction in the motor nerves and so causes a decrease of pain or excitement or hysteria. It also follows from this claim that the excessive improper use of magnets may be followed by pain and interference with the digestion and respiration. According to the difference in the currents of the poles of the magnets the organic activity would be excited or allayed.

The two investigators went to Mr. Edison's laboratory and tried experiments on cats, dogs, frogs, boys and themselves. They took a huge magnet, which had an intensity in the magnetic field of 5,000 c. g. s. lines to a square centimeter. A drop of water placed on the glass slide was distorted in shape by the magnetic force. The effect on bar iron and other minerals was the usual effect of a magnet, intensified according to the strength of the magnet used. Then experiments were made with human and frog's blood. The blood failed to show any traces of polarization, movement or vibration. In the case of live frogs no influence of the magnet on the blood cells or the movement of the blood could be found. When the current was directly through the frog's legs by means of a copper wire placed upon one toe the circulation of the blood grew sluggish and ceased and the blood vessels dilated. When the current was cut off the circulation again became nominal. This was attributed to the direct passage of the electric current as, under other conditions, no such symptoms were observed to attend the influence of the magnet.

To test the German theorist's claims that magnetism increases the resistance to conduction in motor nerves and causes paralysis, a small dog was placed in a cylinder between large field magnets for five hours. There was no effect on the dog; a boy was placed in like positon but there was no effect on the boy. Then the experimenters themselves took turns in lying between the poles of a huge magnet with the current turned alternately on and off. Observations were made of the pulse, the respiration, etc., but no changes were observed.

The observers concluded that the human organism is in no manner affected by the most powerful magnets known and that the brain and nerves get no sensations or impulses from the magnets. Some day magnets may be invented where the number of reversals to the second is high enough and the current strong enough to produce effects on the nervous system but so far as experiments show electromagnetism seems to have no influence on the human body.

There seems to be a great difference of opinion in regard to the success of Governor Flower's plan for the equipment of the Erie canal with a system of electrical propulsion. The Western Electrician in an editorial on the subject says:

"At the present time the state is called upon to expend over half a million dollars annually in keeping the towpath in repair. The introduction of the trolly system would remove the necessity for this expenditure, and the money could be used for deepening the channel and strengthening the banks to provide against washouts.

"At the present time the only serious objection that can be raised to the adoption of the trolley system is the fact that there is not a uniform depth throughout the entire course, and that there is not in some parts of the canal enough water to allow the use of propellors. This, however, could be easily remedied, and the advantages, it would seem, would justify the Legislature in making the necessary appropriation. In this connection Governor Flower calls attention to the fact that Canada is spending $50,000,000 in improving the Welland canal and the St. Lawrence, in order to get a sufficient depth of water to allow of the establishing of a line of steamboats between Chicago, Duluth and Montreal. These steamers will each have a carrying capacity of over 2,000 tons, and could carry grain at five cents a bushel. This leads the governor to remark that 'if New York is not to lose her supremacy as a port the national government should deepen the Buffalo harbor to twenty feet. This would enable vesels to come down the lakes to Buffalo, carrying a thousand more tons of grain than the Canadians propose to do with their steamers. If something of this sort is not done, and if we do not increase the speed of our canal boats, the great bulk of the western grain trade will go to the St. Lawrence. The canal has made the Empire State, and the people should not be slow in recognizing that fact and in bending every nerve toward increasing its efficiency.'"

While the Engineering News of June 15th says:

"The members of the Union for the Improvement of Canals are not enthusiastic over Governor Flower's plan. They say it will cost much more than $1,000,000 to equip the canal, and that the figured cost of 60 cents per day to the boatmen is much too low. Others say that the true solution of the problem is to deepen the canal to 9 feet and then use a steam towage system, with an increased speed per hour of from five to six miles. The trolley presupposes a screw propeller on the boat operated by transmitted power; and many believe that the present section of the canal does not furnish water enough for this use of the screw. The overhead cable system is more favored by some as providing a dead pull, without the slip and waste of power incident to screw propulsion.

"Mr. Horatio Seymour, ex-State Engineer says that the true solution of better canal service is to deepen the canal to 9 feet at least, for no vessel can be propelled with economy in a shallow channel. He believes that this depth can be secured for about $1,000,000 over the whole canal, and that the carrying capacity of each boat would be increased by 50 tons by 1 foot more of draft thus secured."

ELECTRIC LIGHT AND POWER.

VERGENNES, VT.—The Vergennes Electric Company will add a new water wheel.

PHILA., PA.—The Edison Electric Light Company is now erecting an addition to its station.

SHERMAN, TEX.—The Sherman Oil & Cotton Company will add a 750 light alternating dynamo.

WASHINGTON, MO.—Mr. A. A. Tibbe will add to his plant an additional engine and incandescent dynamo.

MEMPHIS, TENN.—The Memphis Electric Light & Power Company contemplate adding an alternating dynamo.

NEW LONDON, WIS.—The New London Electric Light Works will add an engine. A. Hanson is purchasing agent.

BRANDON, VT.—The Neshobe Electric Company will add an alternating dynamo. E. D. Blackwell is purchasing agent.

WAXAHACHIE, TEX.—The Waxahachie Electric Light Company contemplate adding an arc and incandescent dynamo.

BELOIT, WIS.—The Wiley-Warner Electric Company will add a new engine, also storage batteries, if found practicable.

WAUPACA, WIS.—The Waupaca Electric Light Association will add an engine and boilers. W. B. Baker is purchasing agent.

WEST SUPERIOR, WIS.—The Superior Water, Light & Power Company will erect a new power plant and add largely to its capacity.

MINERSVILLE, PA.—The Minersville Electric Light Company will increase the number of its street lamps. M. A. Kistler is purchasing agent.

TACOMA, WASH.—The Commercial Electric Light & Power Company will increase its present capacity this fall. R. S. Hill is purchasing agent.

PALESTINE, TEX.—The Edison Illuminating Company may add an alternating dynamo.

JANESVILLE, WIS.—The H. A. Doty Light & Power Company will double its capacity this summer. H. A. Doty is purchasing agent.

GALION, O.—The municipal plant of the city of Galion is to have its dynamo capacity increased. C. F. Eise is purchasing agent.

NAPOLEON, O.—The Beard Electric Light Company contemplates removing its plant to some other city. W. A. Shelt is secretary.

RIDGEWAY, PA.—The Ridgeway Electric Light Company contemplate adding an arc system soon. H. S. Willard is purchasing agent.

INDEPENDENCE, ORE.—The Independence Water & Electric Light Company will extend its lines. H. H. Jasperson is purchasing agent.

CHAMBERSBURG, PA.—The Chambersburg municipal plant is to have an arc machine added to its equipment. Fred S. Knight is superintendent.

BETHLEHEM, PA.—The Bethlehem Electric Light Company contemplates adding an engine and a power circuit. Geo. H. Wolle is manager.

LA GRANGE, TEX.—The La Grange Electric Light, Power & Water Company will add a 1,000 light dynamo. M. P. Kelley is purchasing agent.

ALLENTOWN, PA.—The Allentown Electric Light & Power Company contemplates a complete renewal of its plant. W. H. Willard is manager.

CLEBURNE, TEX.—The Cleburne Water, Ice & Lighting Company contemplate increasing its capacity in order to furnish power for railway use.

PHILADELPHIA, PA.—The Diamond Electric Company will add 60 arc lamps, for city use. E. S. Baker, superintendent, 17th & Clearfield Street.

IRONTON, O.—The Fort Wayne Electric Company has just completed extensive improvements, and will add a new boiler during the summer. J. R. Cook is manager.

SEATTLE, WASH.—The Seattle Gas and Electric Light Company is to erect a new station and install therein a new engine and boiler. Jno. Mather is purchasing agent.

HOT SPRINGS, S. D.—The Water, Light & Power Company contemplate taking up heating, in all its branches, also adding a power circuit. W. H. Train is purchasing agent.

CARBONDALE, PA.—The Carbondale Light, Heat & Power Company will add an engine, power generator and an incandescent dynamo. J. B. Nicholson is purchasing agent.

MONROE, MICH.—The Monroe Electric Light & Power Company contemplates adding an arc and incandescent dynamo; also a new engine. Geo. R. Hurd is purchasing agent.

OKLAHOMA CITY, O. T.—The Oklahoma City Light & Power Company has just completed its new station house, and will add an incandescent dynamo. S. S. Price is purchasing agent.

YANKTON, S. DAK.—The Yankton Light & Power Company will add two boilers, two engines, one water wheel, one incandescent dynamo and erect a new station. O. R. Brandt is purchasing agent.

Astoria, Ore.—The Astoria Electric Light Company will add an incandescent dynamo and engine, and build a new brick station 100 by 100 feet. J. H. Trullinger is purchasing agent.

Platteville, Wis.—The Platteville Electric Light & Power Company will add an incandescent dynamo in order to furnish lights for streets and dwellings. J. H. Evans is purchasing agent.

Shippensburg, Pa.—The Shippensburg Electric Light Company contemplates adding two 30 K. W. dynamos for three wire circuit, either new or second hand. Clarence J. Reddig is purchasing agent.

Harriman, Tenn.—The city of Harriman has voted to install an incandescent plant, and also to build water works, the whole to cost about $65,000. Thos. Brown is superintendent and purchasing agent.

FINANCIAL.

The stocks of the smaller electrical manufacturing companies have been low, as compared with prices earlier in the year, but have changed little during the month.

The plant of the Detroit Electrical Works was sold on June 13th for $100,000 on a foreclosure suit. Mr. Hugh McMillan held mortgages to the amount of $200,000, and the sale was made in accordance with a plan for reorganizing the company. A New York syndicate is said to have taken the matter up and has promised to invest considerable capital.

The financial situation during the month of June has been one of depression, and at times quite precarious. Bank failures and the assignment of commercial houses, has made the business community more conservative, but the resolution of the New York Associated Banks to issue clearing house certificates in case of trouble, has somewhat quieted the market.

Street railway securities have changed but little, the variation in price being but two or three points in any case. West End common stock of Boston declined from 57 on the 5th to 54½ on the 24th. Pittsburgh traction securities have kept very even, both the bonds and stocks holding up in price very well considering the times. The same may be said of nearly all of this class of securities in other cities.

It will be remembered that the stocks of the Westinghouse Electric & Manufacturing Company declined during the latter part of May to 26 for the assenting shares, and 45 for the first preferred cummulative; at the 20th these stocks dropped suddenly to 20 for the former and 40 for the latter. The sale of these stocks has been light, and at the figures given either would appear to be a good purchase, as the business of the company is said to have never been better, and to be steadily increasing.

Electrical securities, with the exception of one or two, on which the efforts of the "Bears" seemed to center, have suffered no more than others. Stock of the American Bell Telephone Co. reached 196 on June 1st, but re-acted to 188 on the 9th, recovering but a little during the rest of the month. Although sales of Western Union have not been heavy, the price has steadily declined from 85½ on May 26th to 82⅝ on the 24th, being at times lower than the latter quotation. Concerning the other telegraph and cable stocks there has been nothing of special interest.

The dealing in the common stock of the General Electric Company has been heavy, above 350,000 shares being recorded during the month. The price fell to 65 on May 27th, but rallied again reaching 75 on the 12th; it then declined to about 70, and has wavered but little since, standing between 70 and 73 during the last ten days. The sales were heavy during the first part of the month, but fell off during the latter part. Reports as to financial condition of this company, such as were prevalent during the month of May, have not been so numerous for the past month. Reports have just been received showing a heavy decline in the price of this stock, and largely increased trading.

The Wall Street Journal says: "The selling of assets by the General Electric Company has aroused a suspicion that the company is in need of cash to meet pressing needs. We have asked officials of the company for a statement on this point, and find the following to be the facts: The company has realized that a determined attack is being made apparently on its credit, and to place itself, therefore, on a basis financially beyond the possibilities of harm, it has adopted the policy of increasing its cash resources by the sale of such portion of the securities of local companies now in its treasury as can be easily and profitably made. So far the company has sold about $2,000,000 of these, and as was stated in its annual report, proposes to sell others from time to time through some of the many channels open to it. It has in its treasury, at very low valuation, about $7,000,000 more of good local company securities. Negotiations for the sale of many of these at prices above inventory value are progressing. The company sold during the year 1892 more than $5,000,000 of such securities. The acquisition and sale of royalty and other bonds and securities has always formed a secure and profitable part of its business. The company has now on hand, besides the proceeds of the sale just made, $1,500,000 in cash. The company has a comparatively small amount of outstanding debts. The entire amount of such obligations during the next sixty days is less than $500,000. The entire outstanding obligations of the company, including long time paper, which cannot be disturbed until maturity, are but slightly in excess of the cash on hand plus the amount to be received from the various securities recently negotiated. The cash now being accumulated will be used to cancel these liabilities as they mature."

Name of Company.	Description of Security.	Amount Issued.	Par Value.	Rate Int.	Date Payable.	Closing June 24
Miscellaneous Securities.						
American Bell Telephone Co....	Stock.	$17,500,000	100	....	J. Q.	190
" " "	Bds. 1898.	2,000,000	100	7	F. & A.	109
American Tel. & Cable Co.. ...	Com.	14,000,000	100	....	....	82
Commercial Cable Co	Com.	7,716,000	100	....	....	125
Edison Elec. Ill. Co., Boston....	Com.	2,025,800	100	....	F. Q.	120
" " " ...	C.Bds. 1898.	71,000	100	6	M. & S.	.....
" " "	C.Bds. 1901.	586,500	100	6	M. & N.	.....
" " Brooklyn..	Com.	2,500,000	100	....	Q. F.	97½
" " " ..	1st. 1940.	500,000	100	5	A. & O.	100
" " " ..	Regis.	....	100	5	A. & O.	......
" " Chicago...	Com.	3,000,000	....	8	Q. F.	......
" " "		2,500,000	....	....	....	......
" " New York.	Com.	7,173,000	100	....	Q. F.	105
" " "	1st 1910.	2,577,000	100	5	M. & S.	109½
" " Phila......	Com.	1,473,000	100	....	....	117
" " "		....	....	....	....	......
Fort Wayne Elec. Co...... ...	Com.	4,000,000	25	....	....	8½
General Electric Company.	Com.	30,459,700	100	....	......	70⅜
" "	Prf'd.	4,251,900	100	....	....	92
" "	Deb. 1922.	10,000,000	100	5	J.-D.	84
Gold & Stock Tel. Co...........	Com.	5,000,000	100	....	Q. J.	......
Northwestern Gen. Elec. Co....	Com.	1,000,000	100	....	....	......
" " "	Prf'd.	750,000	100	....	J. Q.	107½
Thomson Elec. Welding Co......	Com.	1,000,000	100	....	....	40
Thomson European Welding Co.	Com.	1,500,000	100	..	....	6
Thomson-Houston Elec. Co . .	Series D.	1[illegible]0,000	10	....	....	6
Thom'n-Houst'n Intern. Elec. Co.	Com.	600,000	100	....	....	255
" " " "	Prf'd.	400,000	100	....	....	......
United Electric Securities Co....	Com.	1,000,000	100	....	....	......
" " "	Prf'd.	1,000,000	100	....	F. & A.	97½
Western Union Tel. Co.........	Com.	94,820,000	100	....	Q. J.	82⅝
" "	Var. Issues	13,088,000	100	7&5	M. & N.	......
West'gh'se Elec. & Mfg. Co	Ass'ting.	5,333,940	50	....	....	20
" " "	1st Pf.Cum.	3,755,700	50	7	....	40
Electric Railway Securities.						
Brooklyn—						
Brooklyn City R. R..............	Com.	6,000,000	10	....	Q.-J.	198
" "	1st Bds. 1916	3,000,000	100	5	J. & J.	*102½
Coney Island & Brooklyn R. R..	Com.	500,000	100	....	Oct. 1.	178
" " " ..	1st Bds. 1909	300,000	100	5	J. & J.	100
" " " ..	Certf. 1894.	300,000	100	6	J. & J.	......
Buffalo—						
Buffalo St. Railway.............	Com.	5,370,500	100	5	....	45
" "	Bds. 1931.	5,000,000	100	....	F. & A.	92
Boston—						
West End St. Railway...........	Com.	9,085,000	50	..	J. & J.	54½
" "	Pf'd.	6,400,000	50	5	J. & J.	76½
" "	Bds. 1902.	3,000,000	100	....	M. & N.	......
Louisville—						
Louisville St. Railway Co........	Com.	5,000,000	100	....	....	34¾
" "	Prf'd.	1,000,000	100	5	A. & O.	81
" "	1st Bds. 1930	6,000,000	100	....	J. & J.	95½
Newark, N. J.—						
Newark Passenger Railway......	Com.	6,000,000	100	....	....	30
" "	Bds. 1930.	6,000,000	100	5	J. & J.	89½
New York—						
Union Railway Co...	Com.	2,000,000	100	....	....	140
" "	Bds.	2,000,000	100	....	....	* 98
Pittsburgh—						
Duquesne Traction Co........ ...	Com.	3,000,000	50	....	....	25¾
" "	Bds. 1930.	1,500,000	100	5	J. & J.	100½
Fed. St. & Pleas. Val. R. R.......	Com.	1,400,000	50	....	J. & J.	21½
" " " " "	Bds. 1919.	1,250,000	100	5	J. & J.	100
Pittsb'gh, Aleg. & Man. R. R.....	Com.	3,000,000	50	....		41
" " "	Bds. 1931.	1,500,000	100	5	J. & J.	99½
Pittsburgh & Birming. R. R.....	Com.	3,000,000	25	....	......	19⅛
" " "	Bds. 1929.	1,500,000	100	5	M. & N.	97½
Rochester—						
Rochester Railway Company....	Com.	5,000,000	100	....	....	40
" " "	Bds. 1930.	3,000,000	100	5	A. & O.	91½
St. Louis—						
Lindell St. Railway..............	Com.	2,500,000	100	....	Q.-J.	......
" "	Bds. 1910.	1,500,000	100	5	J. & J.	......
St. Louis & Suburban...........	Com.	2,500,000	400	....	....	......
Union Depot Railway...........	Com.	1,200,000	100	....	....	......
" " "	Bds. 19 0.	1,000,000	100	6	A. & O.	......

* And interest bid.

NEW BOOKS.

Electric Lighting and Power Distribution, an elementary manual for students. By W. Perren Maycock, M. I. E E. Part II. London and New York, Whittaker & Co., Chicago, A. C. McClurg & Company, 117 Wabash Ave. Price, 75 cents.

This volume, part II is just out and part III is now in the press. This volume is devoted to dynamos, motors and lamps of the different styles and types. It is written in a very clear, comprehensive style, contains numerous cuts and diagrams of the different machines, and is entirely free from all complicated mathematical formulae which makes the usual book on this subject so difficult for the non-technical reader.

How to make Inventions or Invention as a Science and an Art. By E. P. Thompson, M.E., New York, 1892. D. Van Nostrand Co., 23 Murray St., 180 pages. Price, $1.00.

This volume contains a great deal of solid imformation together with a large amount of good advice. It is only the persistent worker the experimenter fitted with a thorough knowledge of the matter in hand who is able to bring out an invention. The work will undoubtedly encourage those working out their ideas looking to the perfection of some mechanical or electrical device and perhaps encourage others to enter the field of invention. Mr. Thompson is a mechanical engineer and a well known writer. This is the second edition of the work which has been partially revised and enlarged.

TRADE PUBLICATIONS.

A very neat and comprehensive catalogue has been received from the W. S. Hill Electric Company, Boston, Mass. It contains a most complete list of switches, rheostats and switch board fittings compiled in a very attractive manner.

An excellent description of the heat alarm system as installed by the Electrical Heat Alarm Company of 113 Devonshire St., Boston, Mass., is found in a recent circular of the company. The principles involved and the apparatus employed are well illustrated.

A pamphlet has just been issued by the Jenney Electric Motor Company of Indianapolis, Ind., containing a large number of fac-simile letters from the users of the Jenney apparatus commending its efficiency, durability and expressing the general satisfaction given.

In a handsome catalogue of 35 pages, containing a large number of cuts showing the many handsome and unique designs of arc lamps it manufactures, the General Incandescent Arc Light Company has presented a list of the products of its factories. In general make up it is almost above criticism.

The Knapp Electrical Works has just issued an illustrated catalogue of its house goods, including everything used in connection with the electrical equipment of houses, hotels, offices, etc. The illustrations and descriptions are well arranged, the paper is good and the press work well done.

The Charles E. Gregory Company, Chicago, has just issued a very neat and convenient pocket memorandum book containing a valuable telephone directory of the electrical interests in Chicago, and at the World's Fair grounds. Its value will be greatly appreciated by all who are so fortunate as to secure a copy.

The Ansonia Electric Company has just issued a very handy and neat edition of its house goods catalogue which will be known as B. 44. It is only issued temporarily for use until the larger and more complete catalogue comes out on which the company is now at work. A number of new goods are shown in this catalogue and also some changes in price. It may be had on application.

A very handsome catalogue of the Electrical Forging Company, Boston, Mass., has been received. It is an exceedingly well arranged and made catalogue, and contains a number of full page engravings illustrating the process of electric forging and the machines manufactured; also cuts showing the kind of work done. The work is fully described in the reading matter, which also contains a list of the patents owned by the company and a brief history of the company.

One of the many valuable and improved features in the catalogue just issued by Taylor, Goodhue & Ames is the manner of indexing. The index is placed in a convenient part of the book and includes a general index, an index of trade numbers and an index of all the numerous articles and supplies handled by this firm. The book is substantially bound with cloth covers, well printed, neatly and intelligently arranged. The house goods, central station supplies, line and general supply goods are all very finely illustrated on good paper and make the catalogue a valuable reference book for every user of electrical supplies.

PERSONAL.

Mr. Luke Lilly returned to Cincinnati Sunday night after a short visit to the Fair.

Mr. Carl Kammeyer, of the Jenney Electric Motor Co., Indianapolis, was in town and at the Fair recently.

Mr. L. B. Stillwell, of the Westinghouse Electric & Manufacturing Company was in the city June 21st.

Mr. W. F. Richardson, of the Enterprise Electric Company, returned a few days ago from a ten days' trip in the east.

Prof. Dugald C. Jackson, of the University of Wisconsin, was at the Fair Saturday, accompanied by several of his pupils.

Jas. H. Mason of the Simplex Electrical Co., was in the city recently looking after the company's exhibit in George Cutter's space.

Mr. Franklin Phillips, of the well-known firm of engine builders, the Hewes & Phillips iron works, is visiting the Fair with his wife.

Mr. Charles Van Slyke, of the Kester Electric Co., Terre Haute, Ind., was in the city on business on the 27th and 28th of last month.

Mr. G. E. Emmons, auditor of the Lynn factories of the General Electric Company, with his wife, has been visiting the Fair during the past week.

Mr. H. T. Paiste of Philadelphia is at the Fair looking after his exhibit that has been closed for a few days on account of the decorators working above it.

Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, arrived in Chicago last Friday and will make his home here until the close of the Fair.

Mr. Frank B. Rae of Detroit, was in Chicago last week. He has been retained as consulting engineer by a number of towns that contemplate putting in electric lighting plants.

Mr. W. J. Hammer, chairman of the committee on headquarters for the A. I. E E. at the Fair, arrived last week, and is arranging the rooms of the Institute in the Electricity Building.

Mr. Henry G. Issertel, electrical engineer of the A. B. C. Co., was recently married in Brooklyn, N. Y. The electrical decorations and effects at the wedding far surpassed anything previously attempted.

Mr. W. W. Primm, the electrical engineer of the Department of Electricity, and Miss Adilena M. Stark were recently married. The many friends of Mr. Primm at the Fair extend their congratulations and good wishes.

Mr. R. D. Nuttall, of the R. D. Nuttall Company, Allegheny, Pa., severed his connection with that company July 1. Mr. Nuttall's friends, however, will be pleased to learn that while his plans for the future are not yet ready to be made public, he will, in all probability, continue to identify himself with street railway interests, in which branch of manufacturing industry he has been so long and thoroughly identified.

BUSINESS NOTES.

The Sterling Motor Company, Dexter Building, Chicago, expect to put a new fan motor on the market in the near future.

Mr. Fred N. Howard has just opened an office at 23 Pacific Ave. for the sale of the Fontaine Crossing & Electrical Company's dynamos, motors and fans.

The Mason Electric Company, 10, 12 Vandewater St., New York, was recently organized and incorporated under the laws of New York State. It is capitalized at $25,000. The officers of the company are: President, Mr. A. Vanderwerken; treasurer, A. Vanderwerken Jr.; vice-president and manager, Mr. James H.

Mason, and secretary, Mr. F. B. Johnson. The company will carry a large stock of electrical supplies, and make a specialty of batteries and fan motors.

Cutler & Hammer, Chicago, are receiving orders for their new knife switch in excess of the supply and are obliged to enter orders for future delivery only.

The Stow Manufacturing Company, Binghamton, N. Y., has recently placed on the market a portable electric motor for driving the well-known Stow flexible shaft.

McLean & Schmitt, Chicago, are keeping an increased force of men at work in their shop, doing general repair work, and a considerable of extra work for the World's Columbian Exposition.

The Ft. Wayne Electric Company, Ft. Wayne, Ind., is busy filling large orders for its various kinds of apparatus. Mr. Jas. J. Wood, the superintendent of the company, is at present in New York on a business trip.

Chas. A. Schieren & Co., 46 Canal St., Chicago, make a specialty of perforated leather belting for central stations and power plants. Their exhibits in Machinery Hall and the Electricity Building show the goods for which they are well known and will well repay a visit.

The Tice-Lintner Electric Company, Minneapolis, Minn., are among the pushing electrical houses of the northwest. The new potential indicator recently placed on the market by this company has received many favorable comments from the trade and will no doubt find a ready sale.

The Interior Conduit and Insulation Company are distributing at the Fair very neat and useful souvenirs in the shape of pocket screw drivers. They are nickel-plated and close up in very convenient shape to carry in the pocket. The company's name is neatly etched on the handle.

The Jenney Electric Light Company, Indianapolis, Ind., promise some developments in the line of a new switch shortly. The company are unable to keep up with its orders, especially on the smaller sizes of its motors, for which the demand is unprecedented for this season of the year.

The Hoppes Manufacturing Company, Springfield, Ohio, have recently made a number of large sales of live steam feed water heaters to street railway companies. This company is able, with its excellent shop facilities, to manufacture feed water heaters of any size and capacity.

The Commercial Electric Company, Indianapolis, Ind., notwithstanding its first year of existence is not yet closed, is shipping motors and dynamos, averaging a total capacity of 20 K. W. per day. This is the only company in the United States that makes a specialty of forged iron field magnets.

Queen & Company, incorporated, Philadelphia, Pa., have a new specialty in the Acme portable testing set. It can hardly fail to meet with great favor, as it is remarkably compact and complete, all the necessary parts, including battery, being contained in a handsome mahogany box that weighs but six pounds.

Queen & Co., incorporated, Philadelphia, Pa., carry a large stock of magnetic vane ammeters and voltmeters, which they can ship promptly. These instruments are specially valuable for isolated plants, combining qualities essential for switch board work. A number are in use by various exhibitors at the World's Fair.

The Brush Electric Co., Cleveland, Ohio, are putting in a $100,000 plant at Montgomery, Ala. Mr. Ira J. Britton, for many years chief expert for the company, is in charge of the work. Over 300 men are engaged in the construction. The plant, when completed, will supply both light and power to the city of Montgomery.

Chas. Mundt & Sons, 88, 90 Walker St., New York, report large sales of perforated metal to makers of motors and dynamos. The kind and quality of work done by this firm is well known to all branches of the electrical trade. All kinds of perforated metal are made by them, but a specialty is made of perforated lead for street railway work.

The Eureka Tempered Copper Company, North East, Pa., have a fine display of tempered copper at the Fair. Commutators, segments, brushes, rolled goods in great variety, are shown nicely polished, and arranged in a very attractive booth. This company is well known to the electrical trade by the high grade of its goods, and its exhibit is worthy of special attention.

Mr. H. M. Haines, who has become well known to many of the members of the National Electric Light Association, having accompanied its special train service to and from the conventions, has accepted the office of treasurer of the American Traveler & Tourist Company, a company that conducts a general railroad and steamship business at 849 Broadway, New York.

R. Thomas & Sons Company, East Liverpool, Ohio, has established western headquarters at 115 Dearborn St., Chicago, with Mr. J. E. May, manager. A full stock of porcelain electrical supplies will be kept there which will enable it to supply its western customers promptly. The company has made a number of improvements recently at its factories, including new buildings and new machinery.

The Electric Appliance Company's exhibit of Meston alternating current motor applied to the operation of a sewing machine continues to attract considerable attention and keep a crowd around their World's Fair space. The outfit is certainly a very complete and compact affair and the ease with which it can be controlled leaves nothing to be desired. The outfit is certainly one that will find a very large field.

The Iowa Electric & Construction Company, is the name of a company recently incorporated, and located at Des Moines, Iowa. The officers of the company are: President, E. C. Spinning; vice-president, E. G. Pratt; secretary, J. A. Innes; treasurer, Wm. Bowen. A supply and salesroom has been secured in a prominent building, where the company will take care of the large trade in that section of the country.

The Miamisburg Electric Company was recently organized and incorporated at Miamisburg, Ohio, for the manufacture of batteries, both dry and wet, tempered copper commutator segments, brushes and brush holders and various attachments for dynamos and motor. The officers of the company are T. V. Lyons, president; W. A. Mays, vice-president; Wm. Gamble, treasurer and D. H. Allen, secretary. Capital stock, $100,000.

The Telegraph & Telephone Construction Co., Detroit, Mich., has just removed to its new building containing the new exchange to which it has transferred all its old subscribers. This exchange is a model in every way, being equipped with a new multiple switch board made by the Western Electric Company, Chicago. All of the wires are run underground, and the building and its equipment constitute one of the most modern and best equipped telephone exchanges in the world.

The Electric Appliance Co., Chicago, promises some marked improvements in the Elkhart transformers in the way of a new fusing arrangement, particularly adapted for circuits of 2,000 volts primary. It is also improved by the introduction of a system of removable coils, making it a very simple matter to repair an occasional burn out. Since the Electric Appliance Co. took the western agency, the sales of the Elkhart converters have been very large, and are now used in all parts of the country.

The Western Electric Company, Chicago, has just closed a contract for putting in an arc and incandescent central station plant at St. Clair, Mich. The company has also received a contract for lighting the new Hanneman Hospital, Chicago, with incandescent lights, including the complete electric equipment throughout of annunciators, call bells, etc. The new St. Nicholas Hotel of St. Louis which is to be one of the finest in the country is to be lighted by the Western Electric Company's system of incandescent lighting, the contract for which was closed recently.

The Electrical Engineering Company, 249 Second Ave. So., Minneapolis, Minn., is the name of the company that succeeds the former Electrical Engineering & Supply Company, of St. Paul. Several changes have been made in the officers of the company, but the management is practically the same. The new quarters of the company are much larger, and improved facilities for handling the supplies, places the company in a position to greatly improve its business interests. The entire output of the Northwestern Packard Lamp Company will be handled by the Electrical Engineering Company.

The constant growth of the Railway Equipment Co., Pullman Building, Chicago, is undoubtedly due to its honest intention to furnish the best possible quality of material. For a long time this company has confined its business to electric railway supplies only, and always of the best. This accounts for the success of the company in its chosen field. Some of the largest contracts ever given out in electric railway building have been secured by this company during this season. Mr. Mason, the general manager of the company has always given careful attention to the wants of the trade and with considerate treatment and prompt shipments has placed the company in a position of popularity.

The Todd, Applegate Company, Chicago, bring out this month a new Dry Battery, the Meteor. The special feature of this battery is a hollow binding post, which makes it possible to easily recharge the battery, thus prolonging its life indefinitely. Each battery is guaranteed for two years, and all goods are sold with privilege of returning C.O.D. for full purchase price if not as represented. Some very interesting tests have been made with the Meteor, and in every instance the results obtained have proved entirely satisfactory to the manufacturers. Owing to the simplicity in construction of the Meteor, the manufacturers are able to place it on the market at a price which of itself should make the battery extremely popular.

The National Water Tube Boiler Company, of New Brunswick, N. J., have recently received an order from the Narragansett Electric Lighting Company for 500-horse power of boilers for its station. The first boilers in this plant were furnished by the National Company at a time when the demand for high pressure boilers was very small. These boilers were constructed for 140 pounds pressure, a very high pressure at that time, and the pressure has been increased to a 160-pound working pressure without detriment to the boiler. The last boilers are being made for a working pressure of 200 pounds, with a good margin for safety. The manufacture of boilers for such high pressures is a subject that requires great skill and careful attention to details, for which the National company is well equipped.

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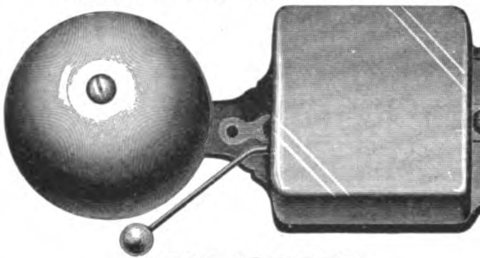

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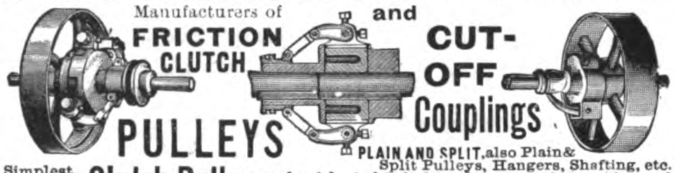

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ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. August, 1893. NEW YORK. No. 8.

Incandescent Lighting at the World's Fair.

What the Exposition would have been without the incandescent lamp is hard to imagine as it is used so largely in the decorations and lighting of the grounds and buildings. Decorations and incandescent lighting have never been undertaken on so large a scale and the arrangement of colored lights in some of the buildings far surpass anything before attempted.

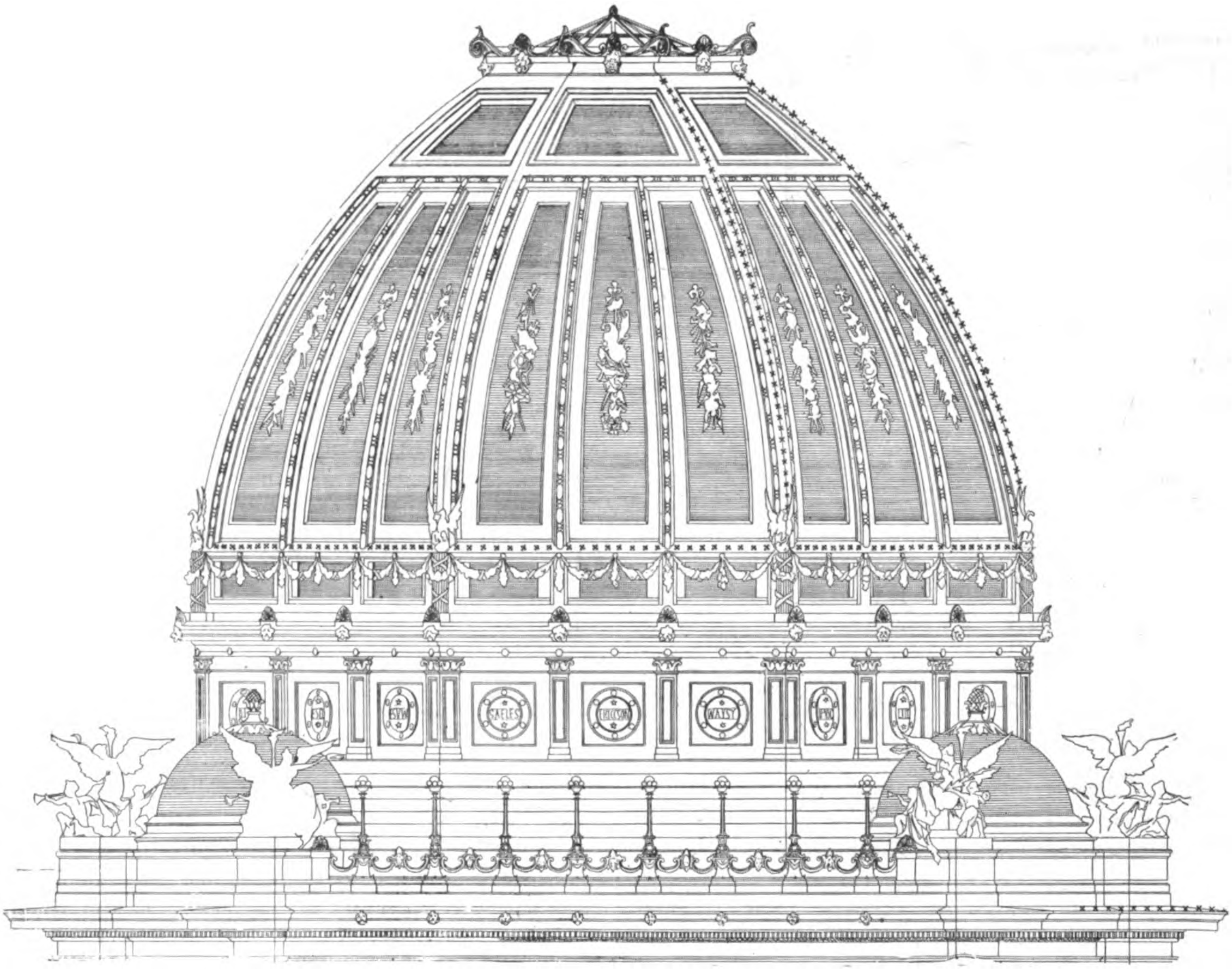


FIG. 1.—INCANDESCENT LIGHTING AT THE WORLD'S FAIR—DOME OF ADMINISTRATION BUILDING.

The arrangement of light around the grand basin and along the cornices and pediments of the neighboring buildings produces a most brilliant effect at night. On Wooded Island a new method of out door incandescent lighting has been introduced. The incandescent lamps are mounted on the top of iron posts seven feet high and enclosed in ornamental globes of different colored glass.

The installation of so large a plant and the construction of a system of this size required a large amount of labor. The entire system has been carefully planned and laid out and although at first glance it appears complicated, on more extended examination it proves to be extremely simple. The primary circuits, of which there are 36, lead from the large switch board on the south side of Machinery Hall through the sub-way provided for the purpose to the different parts of the grounds and buildings. The wire used in the sub-way proper is Grimshaw white core but where the incandescent wires are carried in the underground ducts outside of the sub-way, lead covered duplex standard underground cable is used.

The contract called for not exceeding 15 per cent drop between the switchboard and converter at full load, and as it was impossible to predetermine exactly the number of lamps that would be required on any one circuit, much of the wire was selected with reference to its carrying capacity without regard to the drop, and as large wire was used in most cases, the drop has never exceeded the requirements, averaging nearer 11 per cent than 15. For the longest primary circuits No. 0 and No. 1 B. & S. gauge wire was used. For ordinary distances No. 2 wire, and for very short distances No. 4 wire was used. There are three circuits for special purposes of No. 3 wire. The voltage on the primary circuits at the machine is 2,000 and occasionally 2,200 volts. Owing to the underwriters requirements converters could not be placed inside of the buildings, it was therefore necessary to construct pits outside to hold them and these pits will be found about two feet from the building line throughout the grounds located as the demand for lights required.

The following is a brief description of the construction of this pit: A box three feet deep and in three sizes, four, five and six feet square, is constructed of two-inch plank with two by four-inch posts at the corners extending a couple of inches above the edge of the box. This box is sunk in the earth for two and a half feet and has a cover placed over the top with overhanging sides to prevent the entrance of water. As the corner posts extend above the edge of the box there is a vent between the edge of the box and the cover for ventilation. This box is lined with galvanized sheet iron throughout, all joints being soldered to keep out moisture. The primary wires which are duplex standard underground cable, lead from the sub-way to these boxes where the primary connections from two porcelain fuse boxes are joined to them through a regular standard underground cable terminal head. The primary fuse blocks are fastened to a piece of two by four built across the center of the top of the box. The primaries from the converter are connected to the opposite side of this primary fuse. The secondaries are connected to the main wires entering the building.

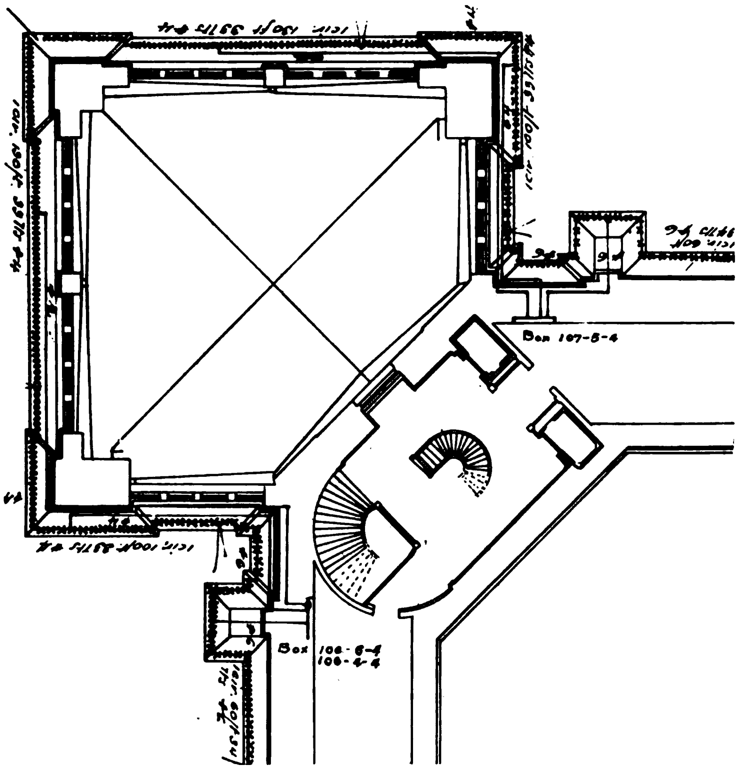


FIG. 2.—PLAN SHOWING POSITION OF LIGHTS ON CORNICE.

As both the secondaries and primaries leave and enter the converter pit considerably below the level of the ground, small compartments made of galvanized sheet iron are soldered on the body of the box making a waterproof receptacle which extends to the level of the top, the wires entering over the top edge of this compartment. This prevents any leakage of moisture into the box from the terminal holes. Another feature is the partition of sheet iron extending across each end of the box and about three inches from it, leaving a space between the lower edge of this partition and the bottom of the box for the entrance of the cold air. In this way the box is well ventilated.

The converters used were designed for this installation by the Westinghouse company and are similar to the regular style, but have no iron outside box or casing. The sizes in use are 40, 100, and 200 lights, the latter size being the one more generally used, and is made up of two 100-light transformers for 1,000 volts with the primaries connected in series. The primary voltage is 2,000 transformed to 100 volts in the secondary. The main wires leading from the converter pit into the buildings are laid in vitrified sewer pipe to a main cutout box, this cutout box being placed as near to the converter pit as circumstances will permit and also in such parts of the building as are nearest to the lights. They are also with few exceptions located as near the floor as possible so as to be convenient for examination and use.

These boxes are made of seven-eighth inch lumber, five inches deep, the other dimensions being such as the situation demands, no two being exactly alike. They are lined with asbestos, and the switches and cut-outs placed therein are on porcelain or slate bases, the structure being as nearly fireproof as it is convenient to make it. The controlling switches and fuse cut-outs for the lamps supplied with current from a box are placed in that box, no scattered switches or fuses being allowed throughout the installation, the only exception to this is the porcelain rosettes that are used for drop lights.

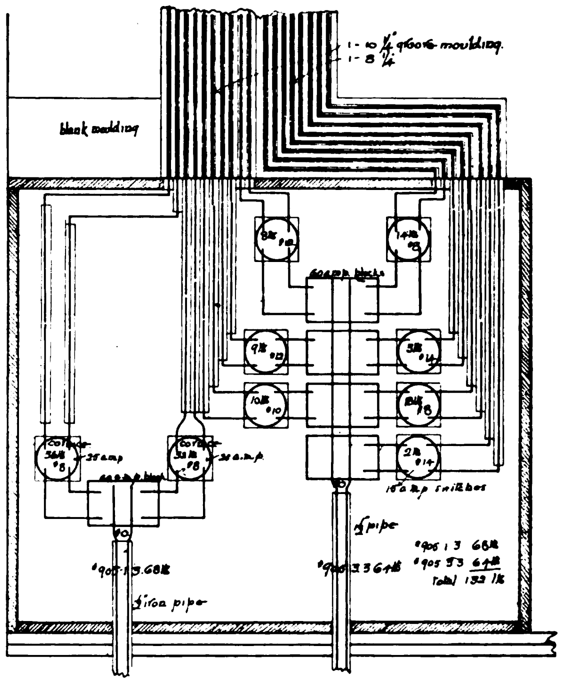


FIG. 3.—PLAN SHOWING ARRANGEMENT OF CUT-OUT BOX.

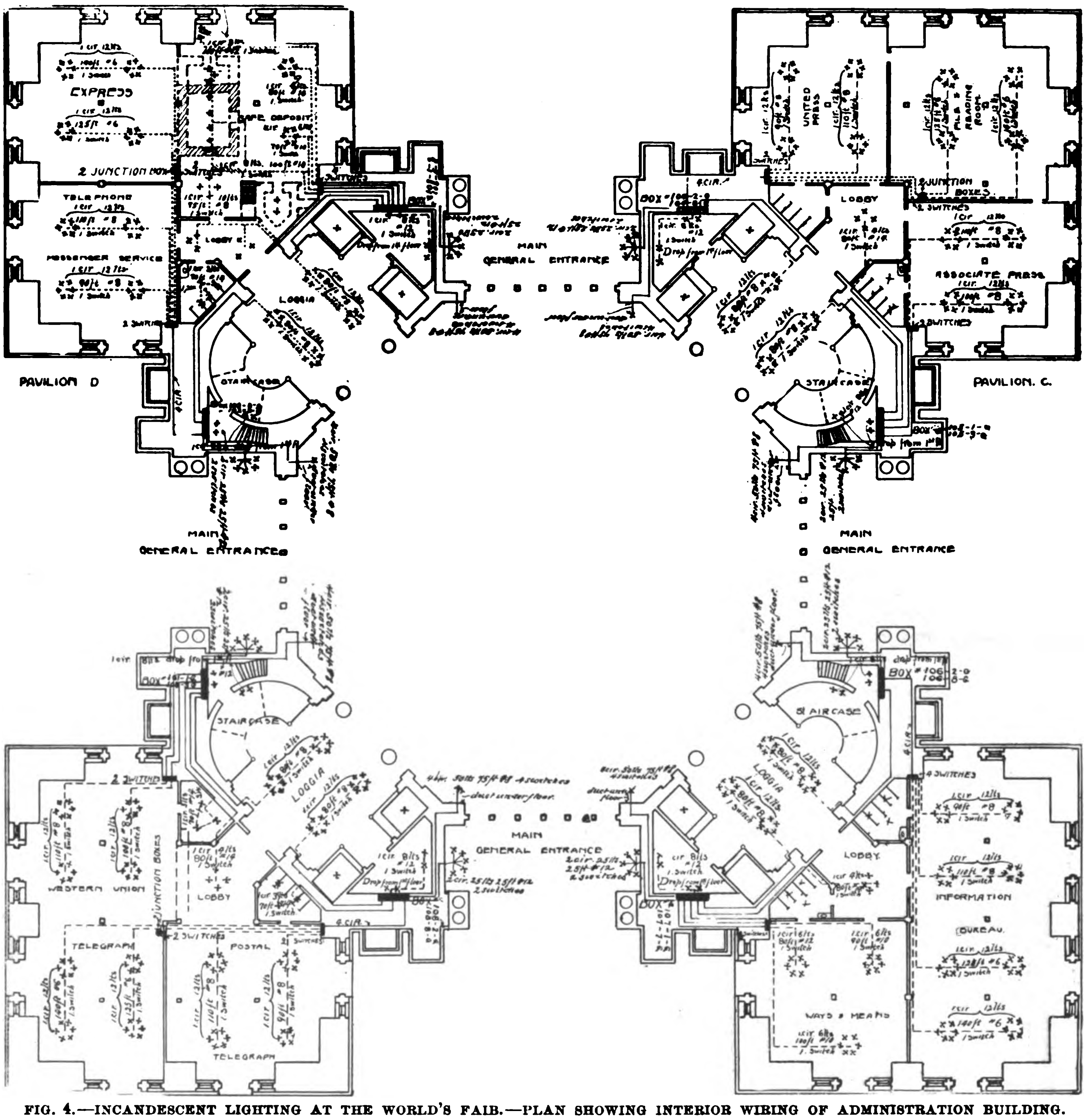
Circuits are so arranged from these cabinets that there shall be not more than 20 lights on any one circuit. The main switches used, that is, the one connecting the line from the converter pits to the sub-circuit switches is of the double pole jack knife pattern and of 150 amperes capacity. All smaller single circuit switches are the Bryant double pole make. From the cut-out box wires lead to the different parts of the building lighted from it.

All circuits in buildings are concealed either behind the partitions or in cap moulding, about one third being in moulding. Where the walls or partitions are thick enough to allow a man to get in between the partitions the circuits are run on porcelain or glass knobs and without other covering than the insulation. In all other places the Board of Underwriters required all concealed wires to be run in some form of tubing approved by them.

Vulca tubing was used throughout the Administration Building but it was soon found that this could not be procured in sufficient quantities, so iron gas pipe was used, the sizes varying from three-quarters to one and a half inches.

Upwards of 65,000 lights have been wired of mostly 16-candle power. 500 Helios arc lamps are connected from the same circuits. The basin and the cornices and pediments of the various buildings around it are lighted by about 12,000 lamps, those around the basin being 10-candle power. The Woman's Building, Administration Building, Fine Arts Building, and all of the State Buildings, as well as the buildings on the Midway Plaisance are lighted by incandescent lamps. The rest of the 65,000 have been used for exhibitors and for decorative purposes inside. Wherever there is head room under a building, it has been lighted so that the watchmen and workmen could see their work. There are some 1,000 lights under the Machinery Hall alone.

It was at first planned to light the Wooded Island by arc lamps, and conduits and cables were laid for that purpose, but it was afterwards decided to use incandescent lamps. New wires were introduced, and neat ornamental iron posts, seven feet high, were erected at intervals of 60 feet on alternate sides of the walks.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SAFE DEPOSIT
2 JUNCTION BOXES
TELEPHONE
MESSENGER SERVICE
LOBBY
LOGGIA
STAIRCASE
PAVILION D
MAIN GENERAL ENTRANCE
UNITED PRESS
READING ROOM
JUNCTION BOXES
2 SWITCHES
ASSOCIATE PRESS
PAVILION. C.
WESTERN UNION
JUNCTION BOXES
TELEGRAPH
POSTAL
INFORMATION
BUREAU
WAYS & MEANS
4 SWITCHES

FIG. 4.—INCANDESCENT LIGHTING AT THE WORLD'S FAIR.—PLAN SHOWING INTERIOR WIRING OF ADMINISTRATION BUILDING.

With the exception of a few handsome chandeliers in the State buildings, little attempt has been made to use elaborate fixtures. The standards used around the corridors of the Administration Building are the only exception. The use of incandescent lights on the exterior of the buildings for decorations, while not new on a small scale, has never until now been used to such an extent as here. The edges of the walls around the basin are lighted by a line of lights placed 18 inches apart. The upper cornices and pediments of all of the buildings fronting on the grand court are also lighted in the same manner, 24 inches apart, while the dome of the Administration Building is beautifully ornamented by lines of light extending around the crown, with other lines on each rib from the highest cornice to the crown. The effect is beautiful in the extreme, can be seen for miles around, and is the most prominent object on the grounds as one approaches from a distance in the evening.

The contract for this plant was let to the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., who undertook to furnish complete equipment from the dynamo to the lamp and also furnish the steam power for about half of the entire equipment. The contract for the wiring was sub-let by the Westinghouse company to the

New York Insulated Wire Company, of 17 Cortlandt St., New York. This sub-contract included all material and labor from the main switchboard in Machinery Hall to the lamp with the exception of converters, sockets and lamps, and was let at a price per lamp for the primary circuits and price per lamp for secondary circuits. Plans of every part of the system have been made in full detail; in fact, it would be difficult to find a smaller private enterprise where the plans had been so elaborated and well carried out.

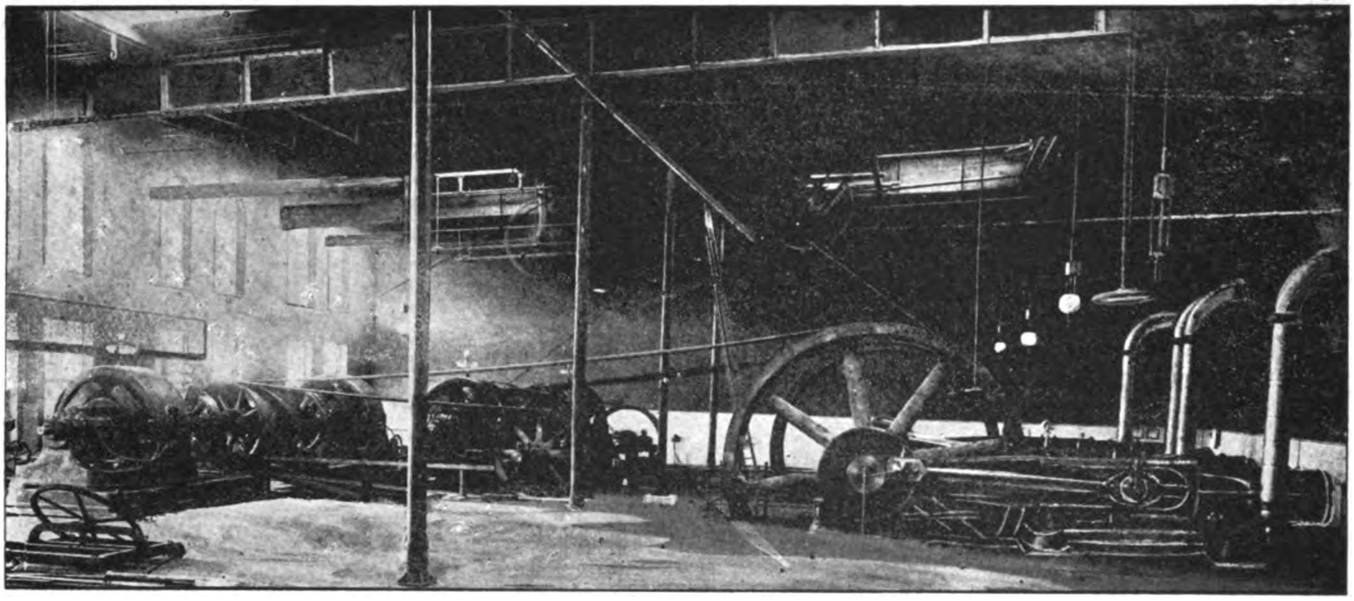

FIG. 1.—ELECTRIC POWER PLANT OF THE CHICAGO CITY RAILWAY.

The Westinghouse stopper lamp is used throughout this installation. On the whole, the installation may be said to be one of great merit, and from its magnitude one of the most difficult that has yet been accomplished.

Electric Power Plant of the Chicago City Railway.

In order to handle the crowds incident to the World's Fair season extensive improvements were necessary in the street railway system of the south side. The old horse car lines have been changed to electric, extended and improved. The equipment is of the latest designs and construction, and to persons interested in the system and power station which is the most modern in every particular it will be found worthy of a careful inspection,

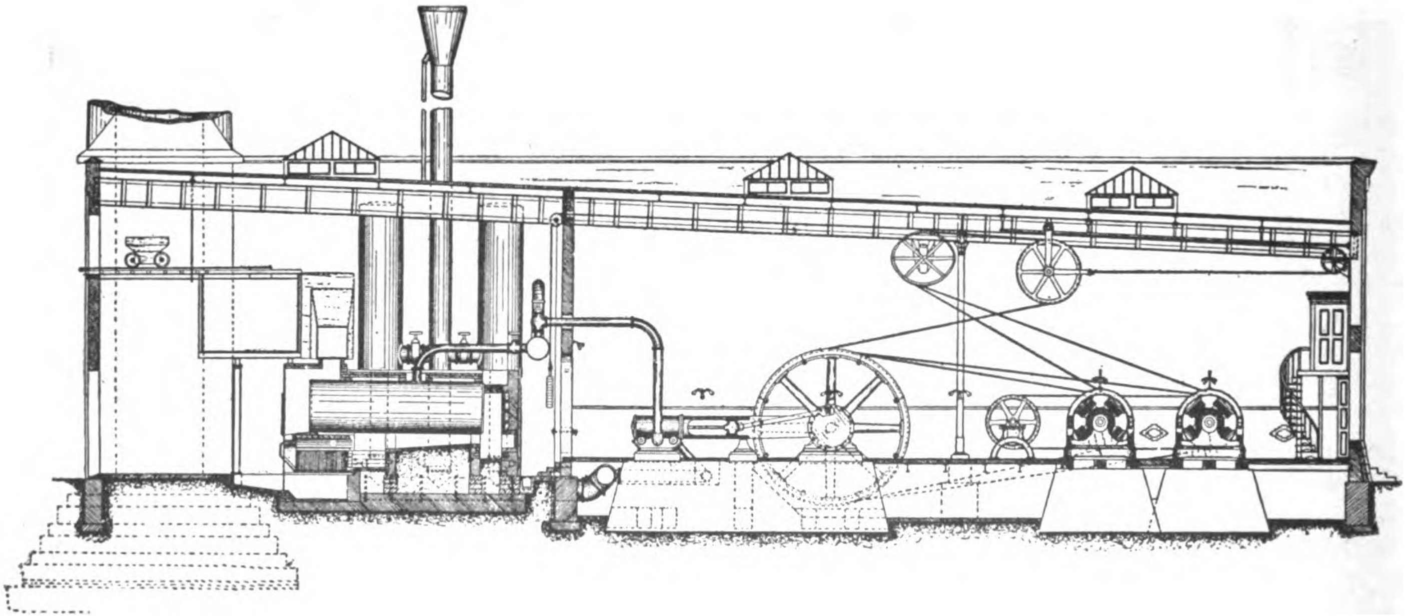

FIG. 2.—ELECTRIC POWER PLANT OF THE CHICAGO CITY RAILWAY—ELEVATION SHOWING ROPE TRANSMISSION.

The building in which the power plant has been placed is on Wabash Av., between 52nd and 53rd Streets, the dimensions being 130 ft. by 147 ft. The outer appearance of the building is finished so as to represent two stories, while in reality it is but one story, 35 ft. in height. Red pressed brick with terra cotta and stone trimmings form the structure. Large skylights afford the best possible light. The boiler room is 56 ft. by 128 ft. inside measurement, and is designed for 14 Mohr tubular boilers 72 inches by 18 ft., each having 64 four inch tubes, and equipped with Murphy smokeless furnaces. Coal is supplied by a coal conveying apparatus running from bins overhead to each furnace, the bins having a storage capacity of 420 tons. The stack is placed so as to form the outer wall of the boiler room, and is in the centre of the two batteries of boilers, each battery having seven boilers. The gases from all these are lead to the stack by means of iron breeching.

The stack is 170 ft. high, 17 feet outside diameter, with 10 ft. flue its entire length. Two Baragwanah heaters are used to heat the feed water for the entire boiler plant, the water entering the heaters direct from the exhaust steam injectors. A very modern system of piping is introduced in this plant. 30-inch drums 52 feet in length extend over the entire batteries of boilers. By means of an 18-inch copper goose neck from the 30-inch drums steam is taken to each engine by means of the 10-inch pipe having a 10-inch angle valve placed next to the drum. Copper joints and elbows are used exclusively. The dimensions of the engine room are 90 feet by 128 feet, finished in white enameled brick. This space is designed to accommodate ten 700-horse power generators of the Westinghouse type number six to run at 300 revolutions per minute. The switchboard for the plant is placed on a balcony in front of the dynamo room directly over the entrance from the street. Entrance is had to the balcony by means of a winding stairway. A separate lighting plant is used for lighting the engine and boiler rooms, which is done by means of ten arc and sixty incandescent lamps.

The engines are to be ten in number, comprising five pairs. They are of the Improved Wheelock type, equipped with Edward K. Hill's valve system, and are running 100 revolutions with 100-pounds boiler pressure, size of cylinders being 24 inches by 48 inches. The engines are very fine pieces of workmanship, and the ease and quickness with which the engine is capable of being stripped and replaced with duplicates is highly commendable. Each pair has an 18-foot built up wheel weighing about 50,000 pounds. The hub is pressed on shaft and each arm (ten in each wheel) is recessed four inches in the hub; the flanges securely bolted to hub with heavy reamed bolts fitted to reamed holes. Each segment of the rim is bolted to the arm with four heavy bolts, and keyed with tapered side keys. The rim is grooved for twenty-one wraps of one and one-quarter-inch rope. The connecting rods are solid steel forgings, with cast steel boxes filled with Magnolia metal. The crankpins are 8 inches diameter by 8½ inches long. The crossheads are of steel with removable pins seven inches by seven and a half inches. Piston rods are five inches diameter. The crank shafts are hammered steel forging 14 inches in bearings and 16 inches in hubs of fly wheel. The main bearings in the frame are built to accommodate

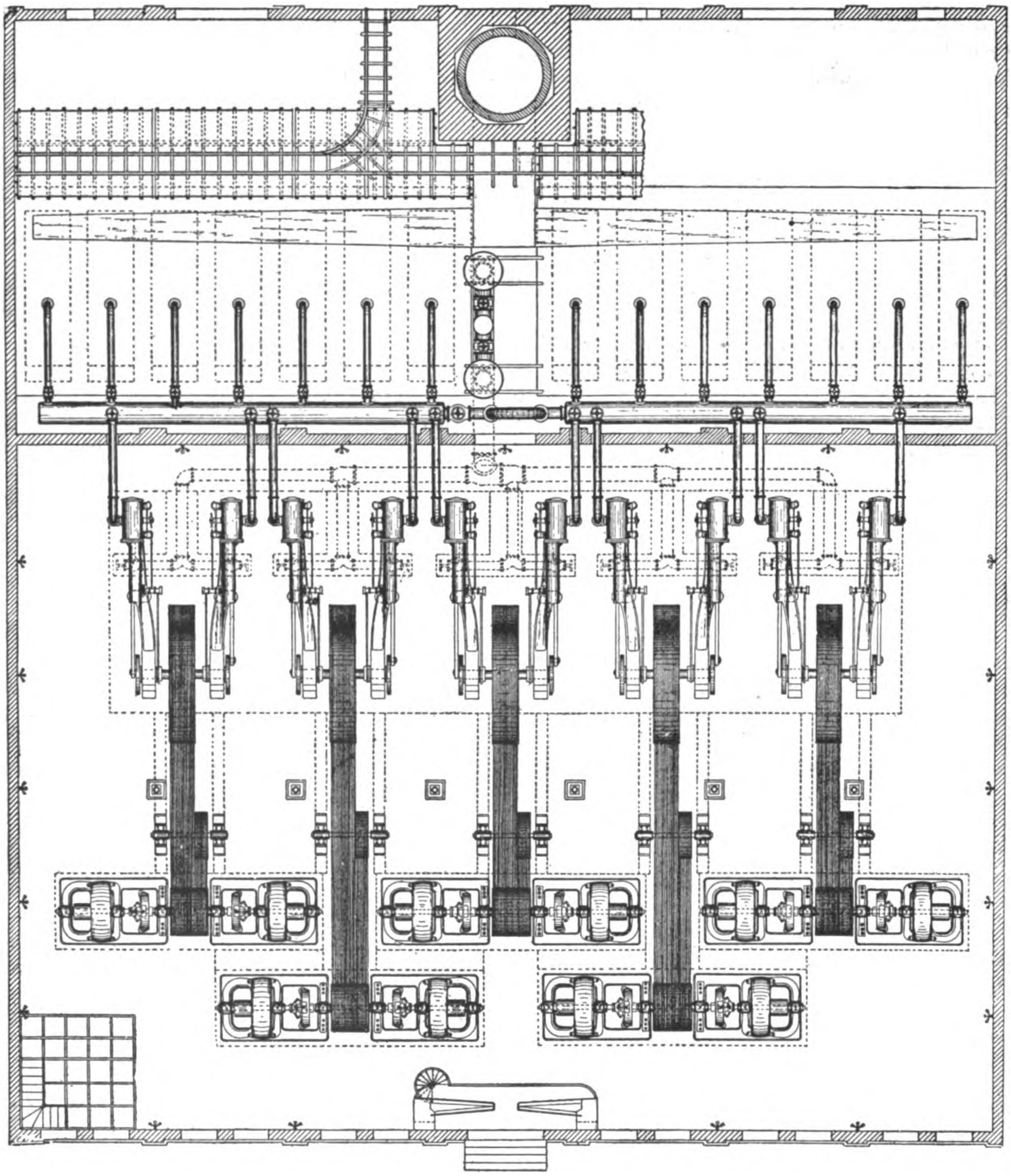

FIG. 3.—ELECTRIC POWER PLANT OF CHICAGO CITY RAILWAY—ARRANGEMENT OF ENGINES AND GENERATORS WHEN COMPLETED.

the 14 inch shaft and are 26 inches long. Metallic golden rod packing is used throughout the engine, and Wheelock piston packing in all pistons. The entire bright work of the engines, including the lagging on the cylinders, is nickel plated, and makes a very elegant and handsome appearance.

Hoadley Brothers, engineers, have adopted a new system of power transmission utilizing in this case Mr. Hoadley's invention, known as the compound wind, which has been used extensively on the Pacific coast for some years. The driven pulleys in this plant are 72 inches diameter, and run 300 revolutions per minute, are grooved for 32 wraps of one and one-quarter-inch rope and drive two 700-horse power generators. The compound multiple winder situated between the engine and driving pulley is 72 inches diameter and grooved for 11 wraps of one and a quarter-inch rope.

The stationary tighteners are 84 inches diameter with one groove. The horizontal carriage pulley running on the vertical shaft is 54 inches diameter and suspended from the ceiling. The rope looks like an endless steel rod, after being lubricated with Bichette rope dsiresng, and its appearance at present is such that it can be said that one set of ropes will last for many years. The California Engineering Company of Chicago contracted and furnished this equipment, it being built under the personal supervision of Messrs. Hoadley Brothers, engineers. The first line to be operated was the 47th Street line running from Western Av. east to Cottage Grove Av.; the second was that of the 35th Street line from California Av. east to State Street and the next was the 61st Street line from State Street to Jackson Park. Other lines have been equipped. It is anticipated that the end of the ensuing year will see all the lines that are now operated by horses changed to electricity, and when completed the electric system of the Chicago City Railway Company will comprise over 108 miles of track, and will have at least 350 motor equipments. 200 cars will have two 25-horse power motors each, and 150 cars will have two 15-horse power motors. These motors, as also the controllers, are of the Westinghouse type. It may be decided that the 25-horse power motors are more advantageous than the 15-horse power, and they will, therefore, be adopted throughout. It is a very common occurrence to see one of these motor cars with three trailers attached, all filled.

Steam Engine Efficiency—Its Possibilities and Limitations.*

BY WM. H. BRYAN.

Among the steam using public there is not a little uncertainty as to just what is meant by steam engine efficiency. And many engineers, who, in the multiplicity of their duties in other directions, have found little or no time for research in this field, are frequently mystified. We are told, for instance, that the exhaust should always be condensed; that engines using steam expansively are better than engines with throttling governors; that double compound engines are better than single cylinder; that triple compound engines are still better; and that if we desire to reach the highest efficiency, we must use the quadruple compound engine.

These statements come from the highest authorities, who point to many instances of success; and yet we need not go far to find cases where results quite the contrary have been found where the addition of a condenser has resulted in an increase in the coal bill; the cut-off engine has proved more wasteful that the throttling engine; the single cylinder than any form of multiple cylinder. So signal have been the failures in some cases, that the business man, judging efficiency solely from the standpoint of dollars and cents, has felt called upon to denounce the whole idea of higher economy as laid down by the authorities, and all the improved appliances thereto. And thus another failure is recorded, and the theoretical is again claimed to be at variance with the practical.

It is necessary to consider the steam engine in two aspects, the ideal and the real. The former is the perfect engine, the thermo-dynamic engine, the engine of the philosophers, of the Carnot cycle. It does not exist, never has existed, and never will exist. The conception of the ideal or perfect engine is simple. Steam considered as perfect gas expands, as many times as we choose, in a single perfect cylinder, the walls of which neither absorb nor give out the heat. We measure its losses by the difference between the temperatures t T between which it works, and its efficiency by $\frac{t - T}{t}$ measured in each case from the absolute zero, 461 degrees below the zero of Fahrenheit. So efficiency of unity is therefore attainable only by discharging the exhaust at the absolute zero of temperature—a condition now manifestly impossible, and likely always to remain so. We see then that the perfect steam engine itself is of low efficiency, due to the comparatively narrow limits of temperature within which we must work. Let us now take up the actual commercial steam engine of today. It has many frailties. It lacks as much of attaining the efficiency of the perfect engine as the latter does of fully utilizing the heat units, which, if the expression may be allowed, pass through its fingers. The apparently simple requirements of the perfect engine are impossible of attainment. Steam is not a perfect gas when saturated—and only approximately so when superheated. The number of expansions possible in practice is limited. High initial temperatures and pressures mean increase in first cost, and cost of maintenance, greater liability to accident, and greater losses through leakage. The limit in the other direction is even more rigidly fixed. A condenser temperature of 100 degrees F. is even lower than can ordinarily be obtained. It is true that Du Tremblay lowered the final temperature to 60 degrees by the addition of another engine working between the temperature of exhaust steam and that of the condensation of ether, by which means he secured an efficiency of 35 per cent for the perfect engine. This plan, however, has not come into general use, and probably never will, on account of the practical difficulties connected with the use of ether.

Furthermore, a large number of expansions in a single cylinder, mean a very large vessel, very rigid and heavy construction, and serious losses due to internal condensation the comparatively cold walls of the cylinder robbing the entering steam of a large number of its heat units, and giving them back near the end of the stroke, too late for transformation into useful work, and where they are swept out by the exhaust.

These difficulties have led to the development of the multiple-cylinder engine, in which the system is worked successively through a number of cylinders in series. This has resulted in a better distribution of the strains, and as Prof. Thurston has recently pointed out so clearly, confines the losses to those of single cylinder working between comparatively narrow limits of temperature. The heat units restored in the latter part of the stroke, instead of being swept away unused, are available for efficient service in the next succeeding cylinder.

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*Abstract of paper read before the Engineers Club of St. Louis.

Practical difficulties are soon encountered here, however, multiple cylinders mean greatly increased first cost for the same capacity, greater complication of parts, and as a result more liability derangement, besides requiring a higher and better paid class of skilled labor in their operation. In addition, there is an increased cost for space and for foundation.

The real steam engine whether simple or multiple-cylinder, is subject to still further losses. Piston speeds are confined within narrow limits; clearance space may be reduced, but cannot wholly be done away with; valve gears are slow in acting and imperfect; valves themselves, as well as pistons, leak; and more or less heat is lost through conduction and radiation.

It is half the battle to be able to definitely and clearly state the conditions, but this is often difficult and sometimes impossible. The question comes to us in a wide variety of forms. We cannot always determine in advance what our load may be; and if we could, it is more difficult in many lines of work to determine the maximum and minimum requirements, and to give them their proper relative value as compared with the average load.

Let us assume, however, that we are able to simplify the problem to that of selecting or designing the type of engine best adapted for a given constant load, of specified duration. This leaves us free to select the initial and terminal pressures and temperatures; the general type of engine, whether single or multiple-cylinder, condensing or non-condensing; piston and rotative speed; and whether we shall jacket the cylinders, and use saturated or superheated steam.

First, it will be interesting to make some comparisons of existing engines of well known types, to determine what efficiency is already attainable in practice, under the most favorable conditions.

EFFICIENCY OF ACTUAL ENGINES.

No	TYPE OF ENGINE.	SUPERIOR LIMIT.		INTERIOR LIMIT.		Steam. lbs. per I.H.P per hour.		EFFICIENCIES.		
		Pressure Absolute.	Temperature F.	Pressure Absolute.	Temperature F.	IDEAL.	ACTUAL	A.	B.	C.
1	Tr. Comp.	140.	353.	1.5	115.	7.925	12.67	.183	.292	.626
2	Condensing.	140.	353.	1.8	109.	7.615	12.91	.176	.300	.588
3	Cr. Comp. Con.	113.	337.	1.7	115.	8.384	13.26	.176	.278	.632
4	Tan. C'mp. Con.	111.	335.	1.7	115.	8.437	14.50	.159	.276	.577
5	Ver. Comp. Con.	117.	339.	2.	120.	8.933	14.07	.174	.271	.635
6	Corliss S. C. C.	72.	305.	4.6	112.	9.289	18.59	.126	.252	.500
7	Corliss N. C.	89	319.	15.9	216.	19.522	25.30	.102	.132	.769
8	Locomotive.	130.	317.	20.2	128.	17.574	26.86	.096	.174	.654
9	Loco've Comp.	151.	336.	19.4	226.	15.331	20.86	.125	.169	.739
10	Slide Valve.	93.	322.	17.2	220.	19.849	32.34	.063	.103	.614

While this data is not as complete as I would like to have it, it is nevertheless worthy of study. The results given under the head of efficiencies are particularly interesting. Column A indicates the efficiency of the engine as regards the total heat units in the steam. Column B indicates the efficiency of a perfect heat engine working between the given limits of temperature. Column C represents the relative efficiency, that is to say, the ratio of the heat units utilized to those available within the limits of temperature between which the engine is working.

The efficiencies shown in column C are of special interest, as they indicate the extent to which each type of engine utilizes its opportunities as a heat engine. The steam consumption of the ideal engine, as shown in column 7, is the limit toward which we should continually draw nearer. The efficiencies in column C show how much our present engines lack of reaching perfection. It is not too much to expect that these efficiencies may be continually improved in time by improving types of engine, as the losses may all be termed preventable, at least in very large part.

Considered wholly as heat engines, the complicated "high efficiency" machines are less efficient than engines of simpler construction. This is as might be expected, on account of the fewer opportunities for leakages and other losses.

The important advantages to be gained by the use of high efficiency engines are:

1st. Reduced fuel bills; and 2nd, reduced first cost for boilers, with their settings, and the space they occupy, there being fewer of them required.

As the second consideration is usually much more than offset by the increased cost and space occupied by the engines; we may reduce the problem to that of the net saving in fuel, and its value in dollars and cents. By the later standard must all such problems be judged. The most ordinary slide valve engine is amply efficient at the mouth of a coal pit, while in distant mountain regions, where fuel is very costly, the highest grade of multiple-cylinder condensing engines are usually justified. This conclusion, however, must be modified in any particular case by the surroundings. Is water available at reasonable cost, for condensing? Can skilled attendance be had; is the engine of a complicated nature, liable to accident, and difficult and expensive to repair? Is the load sufficiently large and constant to insure the results anticipated.

The efficiency of pumping engines is measured in foot-pounds of work done by 100 pounds of coal burned. And in order to eliminate of the question of the equality of the fuel and the efficiency of the boiler, an evaporation of ten to one is often assumed, so that the duty then becomes the number of foot pounds of work done by the engine with 1,000 pounds of dry steam. In order to compare the efficiency of pumping engines with that of ordinary engines, I have deduced the following formula: $D = \frac{1980}{S}$ or $S = \frac{1980}{D}$ In which D is the duty as last defined above and S the pounds of water evaporated per horse power per hour. It is sufficiently accurate for ordinary purposes to call the figures 2,000, which greatly facilitates carrying the formula in ones mind.

The formula as given is not strictly accurate; as the duty is always net useful work, while steam efficiency is usually measured per indicated horse-power. The former, in case of engine No. 1, in our table, was exactly 10 per cent less than the latter. This loss is slightly greater than usual, however, on account of the necessary complicated construction of the engine. It frequently falls to five per cent with ordinary engines of good construction.

Alternating Arc Lighting for Central Stations.*

BY H. S. PUTNAM.

Many arc lamps for use on the alternating incandescent circuits have been placed on the market during recent years to meet the demand for such a lamp. To make a successful alternating arc lamp there are several difficulties which must be overcome. First, the mechanical parts of the lamp must be so constructed that no vibration producing a noise can be set up in them by the alternating character of the current. Second, a carbon must be produced which can be easily volitilized by the current, enabling the arc to be maintained, and at the same time to burn steadily. Third, the hum in the arc itself, produced by the alternating current, should be overcome, or at least reduced.

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*Abstract of paper read before the Northwestern Electrical Association at Madison, Wis., July 20, 1893.

The many advantages in using the alternating arc light for both municipal and commercial purposes are readily apparent. Simplicity, flexibility and uniformity in the style and size of the machinery are essential to the convenient and economical operation of a central station. A multiplicity of machinery, belts and dynamos not only consume an excessive amount of power, but are also expensive to maintain. The number of machines in a station should be reduced and their size increased as much as possible consistent with an economical handling of the load. By using the alternating arc lamp the necessity of a separate dynamo for arc lights is entirely done away with. Many of the stations in the smaller towns can furnish their entire current for all purposes with one machine. If for economical load reasons this should not be desirable, the dynamos can be made interchangeable and used on any circuit. In the larger stations, instead of having a dynamo and circuit for every 50 or 60 arc lights, there is practically no limit to the number of lights that can be placed upon a single circuit and operated more conveniently and much more economically than with the direct current arc system. The large saving in power, cost of maintenance and operating expenses effected by this simplification of machinery is readily apparent.

In the line of construction, there is the same economy and simplicity united also to a greater convenience and smaller first cost. Arc and incandescent lights can be furnished from the same circuit and transformer. Arc lights of any desired candle power can be used, and if desirable charged for at meter rates. The lights are entirely within the control of the consumer, and can be turned on by him when needed. The very large saving thus effected by not being obliged to run all the arc lights and circuit, as is customary at present, to accommodate a few who desire their lights earlier than the balance, would in itself make a very nice dividend in some stations, to say nothing about the satisfaction it is to a customer to be able to have his light when he wants it.

If it is necessary to have any considerable number of lights, such as street lights, under control at the station, this can be very easily and economically accomplished by dividing one wire of the circuit, placing the arc lights between one of these wires and the common return for them both. The return wire, of course, should have a cross section equal to the sum of the other two, and the two latter should be proportioned to the loads they have to carry respectively. By means of a switch, this arrangement places the street lights, or any other circuit entirely under control from the station, takes no more copper, eliminates converter losses when the circuits are not turned on, and in most cases will effect a saving of from 40 to 50 per cent in the first cost of the line construction, as compared to the ordinary arc system.

There is the further gain in this system that both arc and incandescent lights can be furnished at any place along any of the circuits. Usually in smaller cities, and in large ones as well, the incandescent circuits are run only to the main business portion of the city, while the arc circuits form a net-work, practically covering the town. The business in the outlying districts is so scattered that it does not usually pay to run an incandescent or commercial arc circuit to catch it. With the system under consideration, however, every circuit in the city, wherever located, is available for either arc or incandescent lights and for motors also. The amount of scattered business that can be thus picked up would aggregate in many towns to as much as is furnished in the business portion proper, and could be supplied at but a slightly increased expense.

There are several methods of connecting the lamps in the circuit. By far the best and most economical, of course, is to use a special transformer reducing the voltage from 1000 or 2000 to 30 volts. These can be made of various sizes to run any desired number of lights. The ordinary 50 volts transformer can also be changed to give the necessary 30 volts, by tapping a third wire on the secondary wire in the transformer at such a point as to give the required voltage. This will permit the use of both arc and incandescent lights, as the same transformer up to its ampere capacity. Another method is to use a small transformer, transforming from 50 to 100 volts, as the case may be, to 30 volts. This is a very nice method for commercial use, when both arc and incandescent lights are wanted in the same store or building, and avoids the necessity of the third wire that must be used in the last mentioned method. On 100 volt circuits an automatic regulating coil may also be used running three lamps in series. With this coil, one, two or three lights can be run, as desired, and the energy consumed is proportional to the number of lights burning. The four wires necessary in this method is somewhat of an objection. Lastly, the voltage can be cut down by the introduction of resistance from 50 to the 30 volts desired. This, however, is not to be recommended, excepting in special cases, on account of the loss of energy.

Another important consideration is the extremely low voltage at which these lamps are operated and the consequent freedom from danger to life or from fire. The transformer is, of course, placed outside and is not within reach. Only the secondary current is led to the lamps and this only at 30 volts pressure. No special precautions need be observed in insulating the wires or lamps. The lamps can be trimmed and handled with as much freedom and immunity from danger as the incandescent lamps. Street lights can be tested after as freely on wet and stormy nights as on any other occasion, and with absolute safety.

The question of the economical working of electric light plants is deservedly receiving a great deal of attention at the present day. The one machine system is a step forward in this direction. In the station the reduction in the number of dynamos reduces the friction losses materially. Instead of a multiplicity of dynamos, belts and counter-shafting, there is but one machine to look after, only one commutator, one set of brushes, one set of bearings, one armature, and one belt, or better still in a direct coupled machine, no belts at all. The large saving in power and labor thus effected and the increased convenience and economy of such a system needs no argument in its favor.

The alternating dynamos, as is well known, are also of considerably higher efficiency than the ordinary arc dynamos. This united with the use of larger units and the economy in power mentioned above will make a total saving in many cases from 25 to 30 per cent in the consumption of power, and consequently in the coal bill.

The first cost of such a plant is less, and the cost of maintenance and depreciation are materially less than in the ordinary systems where separate dynamos are used for both arc and incandescent lights.

Several of the largest and quite a number of small central stations have already adopted this one dynamo system of lighting, and the indications point to its very general introduction. It is a solution of many of the difficulties which have attended the operation of central stations, and will commend itself not only to the manager and superintendent, but to the customers and stock-holders as well. From one engineering standpoint it unites all the simplicity, flexibility and economy for which we have been striving, giving at the same time the best service for the least money, and for the smallest operating expense. The one dynamo system is emphatically the system of the future.

Hard Rubber as an Insulator in Electric Railway Work.*

BY W. R. MASON.

The extensive use of hard rubber for insulating purposes dates from the early electric railways. Because of its well known insulating qualities, plain rubber has been used as an ingredient in different compounds previously for wire insulation where hardness was not a necessary quality, and when such insulation was needed as would withstand not only the severe weather of our climate, but also the wear incident to its use upon electric roads as line insulation, etc., hard rubber was naturally thought of and put to the test in such service.

The necessity for exceedingly high insulating qualities, as well as firm texture, in railway fixtures is apparent when the large number used upon a road is taken into consideration. The leakage from a single fixture may be insignificant but multiplied through a line of several miles becomes a serious loss.

So far, therefore, as insulation was concerned, the early hard rubber pieces were all that could be desired, but they still lacked sufficient strength to be long wearing under the trying conditions of line service. Attention was immediately given by a certain company to correcting these defects by special vulcanizing processes and satisfactory results were obtained. The fixtures were made of rubber vulcanized to an extraordinary degree of hardness, and did not lose by the process the superior insulating qualities of the first hard rubber insulators. The lack of certain desirable qualities in the earlier hard rubber insulators led to experiments with other insulating substances and these experiments continue, and we trust will continue if improvement will result. Thus far no one insulator has embodied all the desirable qualties found in the hard rubber insulators which have been in use on hundreds of electric roads throughout the world for many years.

Many compositions have been used and successively discarded during the time that vulcanized rubber has been held in favor by railway managers and superintendents. This has not been due to the disproportionately energetic push of its exploiting company, for the sale of the different compositions which have been successively before the trade during later years has been engineered with zeal and a concientious belief, however mistaken, that each was a substantial improvement over hard rubber. But from first to last, up to the present time, hard rubber has been used because of its inherent merit. It has proven its value as an insulator for railway service of extraordinary efficiency. And this involves not only its power as an insulator to withstand a current of 4,000 volts after remaining under water for one hundred days (a test specially applied for determining its efficiency) but also its toughness and hardness to endure the changes of heat and cold and the effect of rain, snow, sleet and ice. Hundreds of tests have been made to determine its efficiency under all severe conditions and it is surprising to note its unaltered efficiency in all circumstances.

An important point to be noticed is the reliability of hard rubber as an insulator. It is a fact, though not always one easy of explanation, that insulators have been manufactured of certain compositions, some of which were of excellent efficiency and others were found to vary an undesirable amount from a proper standard of efficiency. This fault of varying efficiency has not troubled the users of hard rubber. It has been put to the severest tests for a long time and has shown itself constant in its high insulating qualities. This is undoubtedly due to its simple composition.

It is well in considering the necessity for hardness and toughness of insulators for electric railway work to observe more explicitly the reasons for those qualities. It must, of course, be impervious to water or it might soon become useless as an insulator. It must be of the closest texture and fibrous in a measure to render it sufficiently elastic to endure the more or less frequent blows of trolley wheels and poles. A slightly brittle substance soon chips away and makes a renewal of insulators often necessary. This same strength is necessary to bear the building strains of the line. For, as well as an insulator, it is in almost all cases a key to the construction, which failing in its office impairs the whole line. For the very reason of its brittleness, glass—so serviceable as an insulator in telephone and telegraph work—cannot be used to advantage on railway lines.

To produce a substance of highest insulating qualities, not affected by weather changes, strong enough to bear the strains of construction and accidental blows from passing trolleys, of light weight, and of unvarying efficiency, was not an easy task. But hard rubber by a long life of service, has demonstrated its high efficiency in all respects and in all conditions. When we notice the fact that some of the earliest hard rubber insulators are still in use, one is almost justified in believing that there is no wear out to them.

As a proof of the high standard hard rubber insulators have reached, it is enough to cite the cases of many railway managers, who, striving intelligently to reduce expenses, have tried the frequently appearing new insulators, only to return to hard rubber as the best. Some one feature may strike the fancy and reason in a new pattern but when one quality is prominent, others seem to suffer. The widespread use of hard rubber insulators seems to indicate that all the desirable qualities of a railway insulator come nearest to perfection in it and its merit is not based upon theory now, but upon the practical recommendation of scores, even hundreds, of railway managers—its use by them upon their lines.

The first Members' Pocket Year Book of the American Institute of Electrical Engineers has just been issued by the Secretary. It is neatly gotten up in light tinted paper with gilt edges and bound in black leather. On the inside of the front cover is a certificate, stating the consecutive number of the member, and that his membership is continued for another year. A list of all the officers and committees is then given, also a list of all members and associates, revised to July 1st. The geographical distribution of members is shown, enabling them to keep good track of friends in the profession. The rules and past officers are given in the latter part of the book. A calendar for 1893 and 1894, with the dates of meeting for the coming year, is also a useful adjunct. It is certainly a unique idea in year books, and cannot help being appreciated.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

Just as we go to press notice is received of the closing of the Buckeye Electric Company's, the manufacturer of the Buckeye lamp, of Cleveland, Ohio, and the New York & Ohio Company's, the manufacturer of the Packard lamp, at Warren, Ohio, factories, the General Electric Company having secured a restraining order under a decision of Judge Ricks of the U. S. Circuit for the Northern District of Ohio.

In the utilization of the storage battery America is behind that of other countries. One reason for this has been the prolonged litigation over storage battery patents. It is to be hoped that the recent decision of Judge Coxe is an ending to the litigation and that the owners of the active patents will be able to make use of them. The storage battery is undoubtedly capable of greater improvement and is suited in many ways for a more general use in certain kinds of work. No company would undertake the improvement and undergo the expense of introducing an article with the prospect of an expensive suit on its hands. When these patents have expired, which will be in a few years, the field will be open to all and that time will undoubtedly see a large increase in the use of the storage battery.

Neither the favorable decision of Judge Seaman in the Oconto lamp case, nor the declaration of a two per cent quarterly dividend, would hold the General Electric stock up last week. The sudden drop to 31½ on the 28th would seem that investors did not care for it as an invesment, although paying large dividends. The enormous decline of this stock during the past six months has been remarkable. While this decline has been due to a certain extent to sympathy in the general depression of industrials, the manipulations of Wall St. have aided it. On this account, investors seem to be afraid of the stock. The company has been unable to influence the stock for the better, while it is said that the meeting of the directors on the 28th was called to consider the situation the transactions of that meeting have not been made public. The management has been criticized for its policy in continuing litigation against the manufacturers of incandescent lamps, holding that a more conservative policy of licensing the manufacturers of the lamps, and not attempt to get a monopoly of the market, would be more beneficial to the company. The patent has only a short period to run, and the expense of the suits requiring a long time to reach a decision, while the number of new lamps brought out since the litigation commenced are sufficient to supply a large part of the demand, would seem to indicate that the benefit derived, should the company be successful, would be small. It is impossible for any one company to control the electrical business of this country; there are too many interested in the industry. This fact, which has become more apparent to all since the organization of the General company, has also had a depressing effect on its stock.

METHOD OF TESTING DIRECT CONNECTED DYNAMOS AT THE FAIR.

It is proposed to test a number of the larger direct coupled dynamos for the purpose of ascertaining the consumption of steam and the electrical and commercial efficiencies of the apparatus under various loads. Tests of smaller apparatus of this kind may be decided upon later, but arrangements for the same are not yet completed.

Tests will be made for the purpose of helping the jury to form an estimate of the value of the exhibits. Where the jury are able to come to a conclusion without carrying out such tests they may grant awards based on an examination of the exhibits. It will only be practicable, in relation to the particular exhibits referred to herein, to test such representative apparatus as is located favorably in relation to steam supply and can be operated under a desirable load. It is, therefore, to be understood that the awards on the apparatus for which tests are herein provided are to be "granted upon specific points of excellence or advancement," the same as other exhibits, but that an abstract of the general results of the tests will be added to the report for an award, with references to the detailed report on the subject.

There are to be three classes of tests of each apparatus, to be designated A, B, and C. They are:

"A" tests: No less than one or more than three complete tests are to be made with each apparatus, to ascertain the economy in the use of steam and the relation of the indicated horse-power to the electrical output. One of such tests to be made with a load corresponding substantially with the maximum efficiency, one near the minimum allowable load, and one near the maximum allowable load.

"B" tests: Partial tests, supplementary to the above, without measuring the water evaporated, but varying the load by gradual increments through the practicable range, to be made for comparing the indicated horse-power with the electrical output.

"C" tests: These tests are designed to aid in distributing the energy developed in the engine in excess of that shown by the total output in watts to include friction tests of engine and a determination of the resistance caused by exciting the field with the main circuit open; they include also tests of electrical resistance, heating of armature, field, etc.

The order of tests provides that the apparatus shall be first operated at six-tenths of its maximum load for at least four hours before commencing the tests. The first complete or "A" test is then to be made, to be followed by the minimum "A" test, and that followed by the maximum "A" test. In case all of these tests cannot be made in succession the rule as to operating the dynamo four hours, at six-tenths load to be followed previous to each test. The same preliminary run to be made also before commencing the "B" tests.

THE JURY OF AWARDS DEPARTMENT OF ELECTRICITY.

The following is a complete list of the jurors so far appointed and the arrangement of committees:

Henry S. Carhart, University of Michigan; Harris J. Ryan, Cornell University, Ithaca, N. Y.; Benj. F. Thomas Ohio State University, Columbus; Geo. F. Barker, University of Pennsylvania, Philadelphia; T. C. Mendenhall, United States Coast and Geodetic Survey, Washington, D. C.; Robt. B. Owens, University of Nebraska, Lincoln; M. O'Dea, Notre Dame, Ind.; W. M. Stine, Chicago; Sam'l Reber, U. S. Army; Henry A. Rowland, Johns-Hopkins University, Baltimore; E. P. Warner, Chicago; Dr. Chas. E. Emery, New York City; A. E. Dolbear, Tuft's College, Mass.; Wm. Shrader, University of Missouri; S. Brown Ayres, Tulane University, Louisiana; D. C. Jackson, University of Wisconsin, Madison; S. Thompkins, Clemson College, S. C.; R. W. Pope, Sec. Am. Inst. E. E. R. W. E. Ayrton, F. R. S., London; Geo. Forbes, M. A., F. S. S., London; Emil Rathenau, Berlin; Daurath Ulbricht, Berlin; Pierre Dehausse, Belgium; Adolpho Aschoff, Brazil.

Sub-committee No. 1: To have charge of Groups 122, 123 and indicators, registering meters, ammeters and voltmeters of Group 126. Messrs. Ayrton (chairman), Mendenhall, Rowland, Owens, Stine and Thomas.

Sub-committee No. 2: To have charge of Group 124. Messrs. Dolbear, Stine and Shrader.

Sub-committee No. 3. To have charge of Groups 125, 127 and 128, and j, of 138 a. Messrs. Carhart, Emery, Forbes, Jackson, Reber, Ryan and Rathenau.

Sub-committee No. 4: To have charge of Groups No. 126 and 129. Messrs. Thomas (chairman), Ayres, Owens (sec'y), O'Dea, Thompkins and Ulbricht.

Sub-committee No. 5: To have charge of Groups No. 130, 131 and 133 and L. M. of 138 a. Messrs. Barker, Ayres, Rathenau and Warner.

Sub-committee No. 6: To have charge of Groups 133 and 134. Messrs. Ayres, O'Dea (sec'y), Pope (chairman), and Ulbricht.

Sub-committee No. 7: To have charge of Group No. 135. Not yet appointed.

Sub-committee No. 8: To have charge of Groups 136, 137, 138 and 138 a. Not yet appointed.

The Electric Railway at Los Angeles.

Los Angeles, Cal., bids fair to be quite lively in electric railway circles. Mention was made in a former issue of an electric line about to be built from Pasadena to Los Angeles, which the California Engineering Company is contracted to furnish. We now learn that the parties behind this enterprise are composed of some of the principal stockholders in the Pacific Railway Company that invested so largely in Los Angeles cable roads. Mr. John F. Crank, formerly receiver of the Los Angeles Cable Railway Company is at the head of this new electric line, and it is understood that these parties will make a bid for the cable line as it now stands at the foreclosure sale in August, and if they are the successful bidders they will immediately equip this line with electrical apparatus and utilize one of the power stations for their electric stations for all the lines. They will also purchase an extensive horse-car line now in operation in that city, which they will equip with electricity and run in connection with their cable lines. Should they not succeed in obtaining the cable property their intention is to extend the horse car line running it in connection with the line to Pasadena. In a coming issue we hope to illustrate the power house machinery, which is to be something out of the ordinary and it is said the entire plant, should the cable property not be purchased, will not cost to exceed $800,000, and will cover the most valuable territory in Los Angeles County.

Decision in the Oconto Lamp Case.

The following is an abstract of Judge Seaman's decision in the suit of the Edison General Electric Company for injunction against the Electric Manufacturing Company of Oconto, Wis.:

"Edison's discovery was published late in 1879. It promised an incandescent electric lamp which would supply the great want of an operative commercial light, suitable for domestic uses, cheap and practical, and aroused great interest and excitement in commercial and scientific circles. Lighting by electricity has long been an accomplished fact in arc light and various single burners, but the problem which remained unsolved was a method of subdivision of the light for which scientists in Europe were seeking, and which many of them pronounced impossible, an ignis fatuus. It was the solution of this great problem that Edison thus announced. As stated by Justice Bradley in the McKeesport case, 40 Federal Reporter, pages 29 to 31: 'This was the real, the grand discovery in the art of electric lighting, without which it could not have become a practical art for the purpose of general use in houses and cities. We think we are not mistaken in saying that but for this discovery electric lighting would never have become a fact.'

The invention claimed by Edison was a lamp which is the embryo of the best lamps now in commercial use. The second of his patents here involved described it as follows: 'The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass and from which receiver the air is exhausted, for the purpose set forth.'

The thread of filament of carbon for a burner was the fundamental discovery to obtain this subdivision of electric light, for by its use he obtained the high resistance which was essential to the multiple arc system, and saved the use of enormous conductors of the electric current, the cost of which was otherwise prohibitive of subdivision. He found that for stability of this thin carbon it was necessary to have a high vacuum and remove all gases, to prevent what he calls 'air-washing.' This led to the entire glass receiver or chamber for the lamp, and finally to platinum leading-in wires, sealed into the glass, because 'the co-efficient of expansion of glass and platinum was the same,' and the high vacuum would be retained, while iron or copper wires would be destroyed. This discovery was, therefore, in successful steps, and only essential for the great object of subdivision of light.

"Each of these steps is claimed to have been discovered or taken by Henry Goebel many years before Edison. Against all the improbabilities of this claim, the story as related by Goebel, in his several affidavits, with detail confirmation by many witnesses, is interesting, circumstantial, and in many respects plausible. I do not wonder it has attached such earnest advocacy by able counsel in contesting this case. Henry Goebel is now seventy-five years of age, a German, who came to this country in 1849, and has ever since resided in New York. He appears to have been an excellent and ingenious mechanic, engaged in watch-making, manufacturing barometers and thermometers and delicate instruments, and has shown much interest and aptitude in electrical appliances and experiments. He claims to have made incandescent electric lamps identical with the Edison claim in all its particulars from about 1854, and that these lamps were operated by primary batteries of his own construction, and used at his store for show and lighting in various ways, and for some had such lamps on a wagon traveling about the streets of New York, with a telescope, also of his own construction.

"He says he made many of these lamps each year, prior to Edison's patent, all for his own use or gratification, but not so many after 1872 as before. In 1880 and later, he was engaged in making lamps for the American Electric Light Company, a rival of Edison's, and making similar lamps. This meager statement cannot fairly present his story, but must suffice with mention that he was, before leaving Germany, intimate with a Prof. Munchausen, who has experimented with the production of arc and incandescent electric light, and gave the ideas which he carried out here. Goebel does not claim that he ever worked a thought in the line of subdivision of electric lights, and the history of that art presents strong grounds for doubt.

"1. The fundamental thread-like carbon burner of Edison's only because necessary as a means to subdivision of electric light, which was not contemplated by Goebel. The latter operated with a primary battery, for which the larger 'pencil' form of carbon or other material would answer as well, would be more stable, and more easily made. This filament is most delicate and difficult to make, and must have a high vacuum, or it would be instantly consumed. It seems unnecessary and undesirable for his purpose, and no satisfactory reason is given for its adoption by him.

"2. The Goebel lamps are not shown to have had the high vacuum required for anticipation. His principal statement must be taken that he exhausted his lamps by the Torricilion method in the years prior to 1879, and I think it is abundantly shown, although not without some contradiction, that such a method could not produce the vacuum necessary to prevent disintegration of the carbon, and it seems doubtful whether it could be employed at all with this delicate carbon in the receiver. If that vacuum was wanting, the claim fails.

"3. No motive is shown for such constant manufacture of these lamps throughout the years from 1854 to 1880, involving so much of time and expense in maintaining the batteries for their use, and no attempt to dispose of even one, or to utilize them for domestic purposes, excepting in a few stray instances. It seems improbable that the constant practice here asserted, and so useful for the purposes of this defense, should have been kept up without clear object.

"4. Why did he not apply for a patent? He was not ignorant of the patent laws, for in 1865 he is shown to have applied for a patent on a sewing machine hammer, and in 1881 he is found applying for some minor improvements, one of them being a coil, shown in his exhibit lamps.

"5. The lamps which Goebel produced at Boston, as original lamps made in the early years, were four, called Exhibits 1, 2, 3 and 4. The first three only were produced at the hearing with his original affidavit, the fourth being in the hands of counsel for defendant, but withheld, because of doubts as to its authenticity, which doubts were afterwards cleared to their satisfaction, and this lamp then introduced by leave of court with additional and explanatory proofs. The first three had copper and iron leading-in wires, were of the Goebel 'meat-saw' pattern and show no vacuum now, and if fully proven would not constitute anticipation of Edison. No. 4, called the 'hair-pin' pattern, was the requisities, including a vacuum, although probably not the high vacuum. It is not now operative, by reason of some defect. Goebel swears that it was operated, but experts who have examined the defect swear that it has existed from its manufacture, and it could not have operated. This lamp shows the highest excellence of the glass-blower's art, is stated by experts to be beyond the ability of any amateur, and many peculiarities are pointed out in the perfect shape of the carbon, the glass bridge and position of leading-in wires, which seem to show adoption of methods which have produced and developed from the experience of commercial manufacture with Edison's invention. The statement as to its make, its keeping or its having been operated are not clear or convincing to the court, if they have been so to counsel. Exhibit lamps Nos. 9 and 11 brought to St. Louis, are no more satisfactory than No. 4.

"6. After Goebel's employment in lamp-making by the American Company, his claim of anticipation received some attention, and he had negotiations with one Dreyer in 1882 for arranging a company to exploit the claim. It failed, because he was then apparently unable to produce an original lamp. Later, it was investigated by eminent patent lawyers at various times, and apparently with great care and interest, to employ it in defenses against this patent, and also by one in behalf of complainant, and all rejected it as not well founded. Prof. Thomson, of the Thomson-Houston Company, investigated it in 1882, when it would have been of vital interest to his company to make use of it against this patent, if tenable, and after visiting Goebel he rejected its consideration. Dr. O. A. Moses, an inventor with similar object, visited Goebel frequently, but came to the same conclusion, and says he was unable to produce any lamp.

"These are potent circumstances to raise doubts. Coming to the new testimony produced, which I have carefully examined, I find that the depositions in behalf of the defendants are mostly cumulative or in rebuttal of certain new defendants introduced by the complainant and not here considered; but I cannot find that they remove any of the doubts above noted.

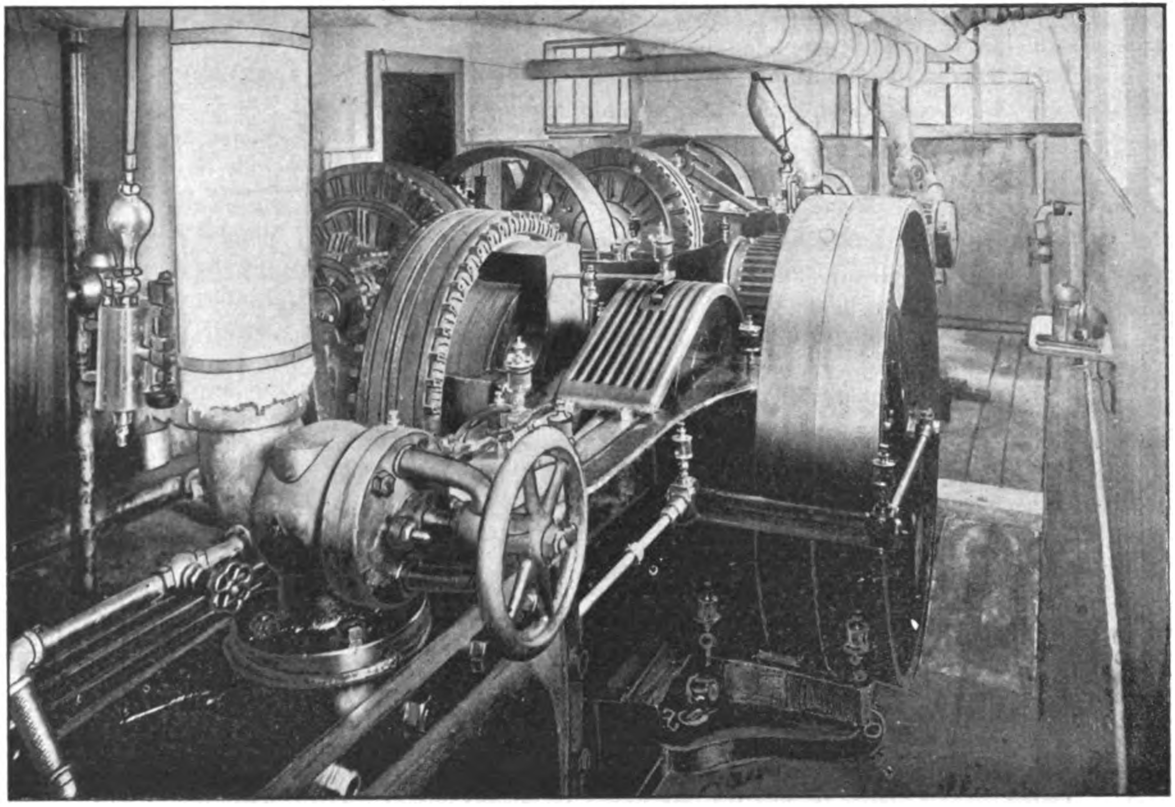
"On the other hand, affidavits now produced by the complainants tend to show an admission of defendant's witness, Henry Goebel, jr. (a son of the complainant), that he manufactured exhibit lamps Nos. 1, 2 and 3 in 1892 for the purposes of this case. There is no denial of this, but it is claimed that his son is venal and has deserted the defense to favor the complainant. One Heger, a glass blower, swears that he made for Goebel, while working for him 'in the early 80's,' lamps similar to No. 4, and he thinks he made this one at that time. As to a plauer which was produced by Goebel as made by him at an early day, he cut bamboo for his carbon burners. One Korwan and Heger swear that it was actually made by the former in 1883. This is contradicted as to date by an affidavit produced by defendants.

"Upon the whole showing, I am satisfied that complainant is legally entitled to preliminary injunction, and that it is the duty of the court to grant it without evasion. As stated by Judge Colt, and often held, a bond by defendant is not the equivalent of the injunction which the law gives for the protection of the inventor in the exclusive privileges promised by his patent. Injunction will therefore issue but with leave to defendant to move for requirement of a bond by complainant to indemnify the defendant for any damages he may suffer if it shall finally be held that the patent is invalid."

A convention of gas and electric fixture manufactures is to be held in Chicago on the second Tuesday in August.

A Recent Installation of Waddell-Entz Dynamos.

The Waddell-Entz Company have been quietly at work for the past three years perfecting their direct-coupled generators and motors, believing that the time was rapidly approaching when the great advantages of making the dynamo and engine one machine, thus dispensing with pulleys and belts, would be appreciated by the public. The high armature speed of the dynamo has long been one of its drawbacks, but in the Waddell-Entz multipolar type of dynamo as noticeable an advance has been made as that seen in the evolution of the high-speed engine. By presenting a greater number of poles to the armature, the same rate of change in cutting the lines of force is secured with a much lower number of armature revolutions.



A RECENT INSTALLATION OF WADELL-ENTZ DYNAMOS.

Their faith has been abundantly rewarded by the installation within the past year of a large number of direct-connected lighting and power plants in some of the most prominent office buildings, factories and street railroads in the East.

They now propose pushing their business in the West, and have just installed a plant in the Windermere Hotel, near the north end of the World's Fair grounds, Chicago, which we herewith illustrate. The peculiarity of the plant may be appreciated by a glance at the accompanying illustrations. The dynamo-room, 14 ft. wide and 16 ft. long, contains two 50 K. W. and one 30 K. W. dynamos, each directly connected to a McEwen simple engine. The armature, of the outside gramme ring type, is supported directly on the engine shaft and revolves outside of the pole pieces taking the place of the fly wheel. The pole pieces are energized by one exciting coil. This is quite a departure and a most important feature of the machine, as the compounding can be made to any degree by simply shortening or lengthening the compound coil, which is a sheet of copper wrapped around the shunt coil. The magnets, for any number of poles, are cast steel in two sections; consequently there is but one magnetic break. The advantage of homogeneousness in the magnets is that the machine will regulate absolutely through the full range of no load or full load. The extended shaft is supported at its outer end by an independent bearing; this bearing is bolted to a base plate common to the engine and can be made adjustable if desired. A change is made in the patterns of the engine frame to provide for carrying the fields. It will thus be seen that the whole combination is very little larger than an ordinary engine, the only additional space required being that for the commulator and outside bearing. The 100-horse power combination occupies a space 10 feet by 7 feet and the 50-horse power 9 feet by 6 feet.

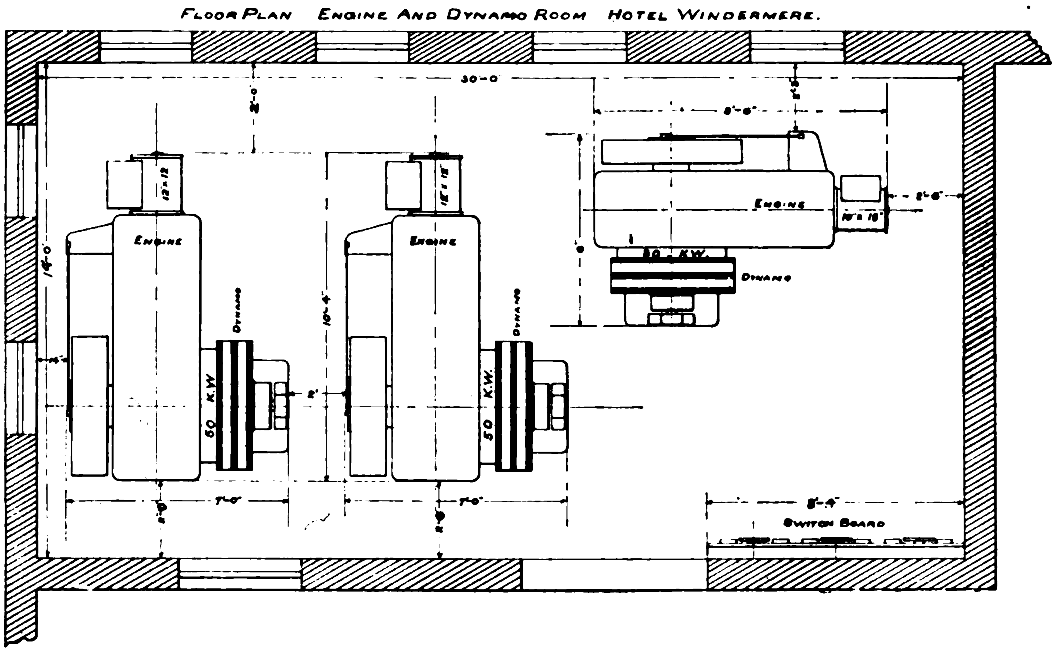
The Windermere plant was installed by the Orne Construction Company, of Chicago, and Chief Engineer Williams, of the Windermere Hotel, speaks in a complimentary manner of the efficiency and reglation of the combination.

The Royal Alternating Dynamo.

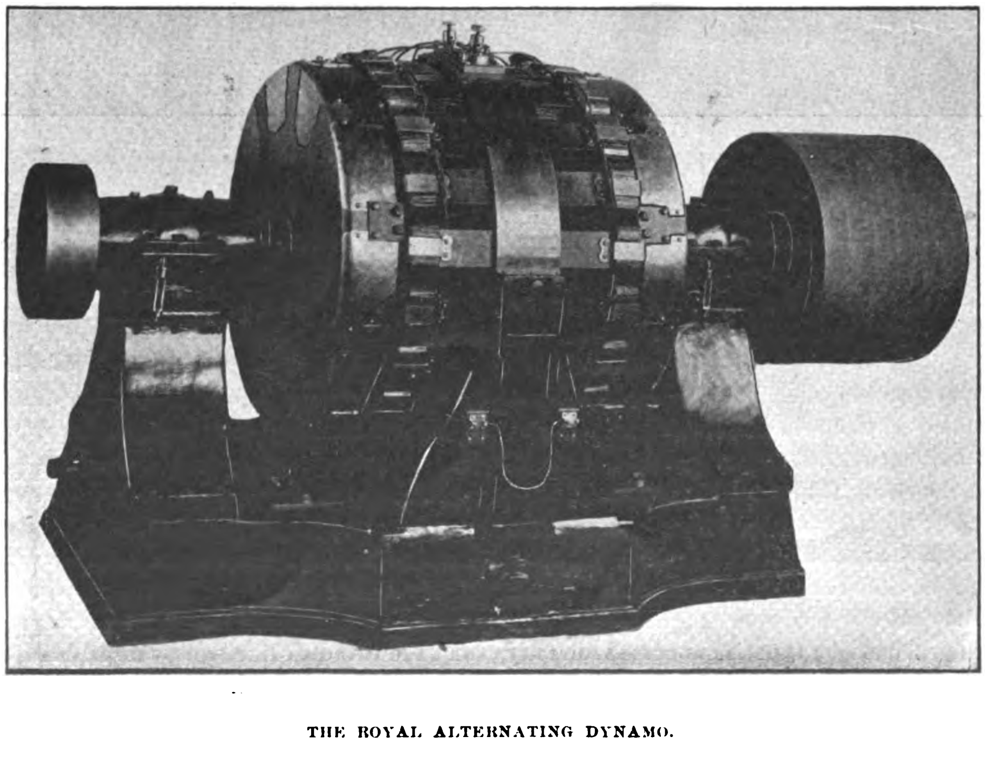
An alternating current dynamo of unique design and construction is shown in the accompanying cut. It is so constructed that neither the armature nor field magnets revolve, and consequently there is no commutator nor brushes used in connection with it. The advantages of this method of construction are readily seen.

The parts that revolve with the shaft are the magnet core and the two disk-like pole pieces. A much better insulation may be maintained, which is important in machines generating currents of high tension. The machine is well made; the windings carefully made and securely fastened in their proper places. The shaft is of sufficient size so that it will keep its proper position, and is equipped with a well made pulley at each end. The boxes are of improved construction, and the oil cups of the latest self-oiling pattern. The base that supports the machine is of solid and substantial size, so that the whole machine is held rigidly together.

A shunt dynamo is used for the exciting circuit, with a resistance so arranged that the exciting current of the dynamo may be varied to compensate for the various changes in the dynamo, drop in the line and variation in the load, thus keeping the electromotive force constant at the lamps. In connection with this dynamo there has been placed on the market the Royal Transformer, in sizes ranging from five to 1500 lights. These transformers are of novel design, and in their construction great care has been taken in selecting the best material only. In assembling the parts, perfect insulation of the connections and all parts is sought, and before they leave the factory they are subjected to a severe test, a liberal allowance being made in rating their capacity. They are put in weather proof iron boxes, and provided with a fuse box, so that they can be fused with safety and ease while the current is on.



A RECENT INSTALLATION OF THE WADDELL-ENTZ DYNAMOS.



THE ROYAL ALTERNATING DYNAMO.

These machines and apparatus are placed on the market by the Royal Columbian Electric Company, of 54 Dearborn street, Chicago. The president is Mr. H. H. Natwick, treasurer, Mr. J. I. Stene, and secretary Mr. H. R. Fish, Jr. The company is capitalized at $50,000, and has a contract for the entire output of the factory of the Royal Electric Company, at Peoria, the manufacturers of the Royal dynamo. The members of the company are well known business men, who, with their extended experience, are able to enter successfully the electrical field.

The Pennsylvania Railroad Company has made a decided change in the method of communication between its more important offices in the installation of a long distance telephone system. By this means much valuable time will be saved in the transaction of important business. Another advantage of the system is the ease with which confidential business may be transacted between the officials.

A Thirty-Ton Electric Locomotive.

For some time the appearance of a heavy electric locomotive has been looked for. The first one of this kind has recently been produced by the General Electric Company, illustrations of which are shown in the accompanying cuts. These locomotives possess many advantages for use on short lines as their use on long distances is at present limited by the cost of long lines of electric feeders. On short lines when the traffic is heavy it is peculiarly adapted.

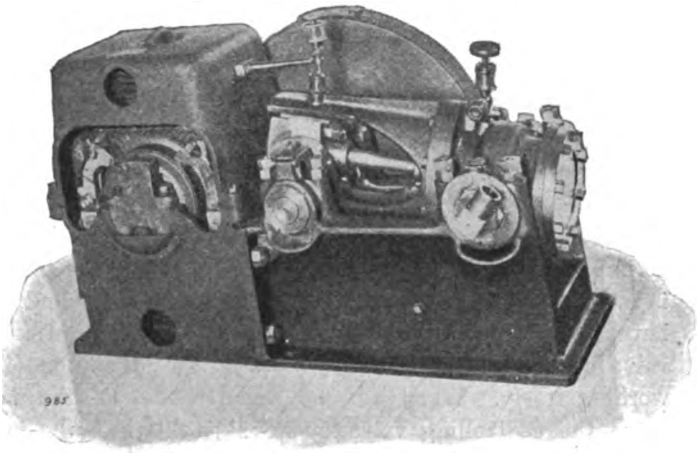


FIG. 1.—THIRTY-TON LOCOMOTIVE—THE AIR PUMP.

As a result of the appearance and the demonstration of the usefulness of this pioneer engine, others will undoubtedly be built for special service. This locomotive has been designed for normal speed of 30 miles per hour; is of 30 tons weight and intended for operation on elevated railways, for passenger and light freight traffic on less important steam roads. It is solidly and substantially built of compact construction and runs on four 44 inch wheels. The main dimensions are 16 feet 6 inches long, 11 feet 6 inches high, 8 feet 4 inches broad with draw bars 2 feet 6 inches from top of the rail. The draw bar pull is calculated at 12,000 pounds. Its power is furnished by two electric moters especially designed and constructed for this purpose, one motor being provided for each axle. The motors are gearless and are supported on spiral springs resting on the side frames of the locomotive truck. By the use of this method of suspension the wheels are free to adjust themselves to the irregularities of the road bed and consequently diminishes the wear to both trucks and motors.

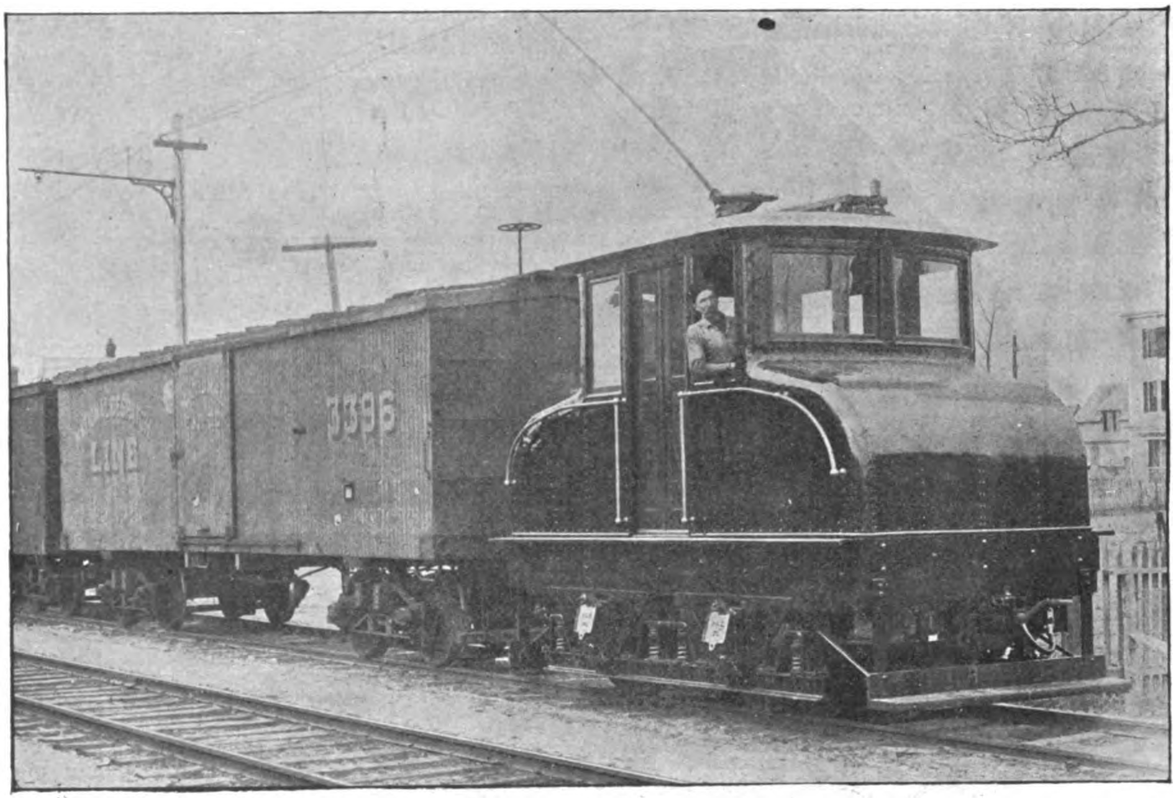


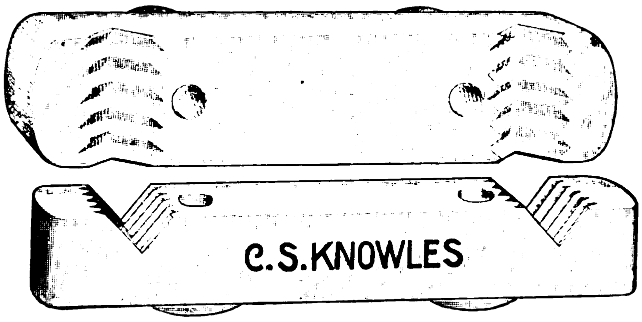
FIG. 2.—A THIRTY-TON ELECTRIC LOCOMOTIVE.

The hollow field spools are bolted to massive castings. The armatures are of the iron clad type having each separate winding embedded in a mica lined slot, cut into the curved surface of the laminated iron armature core. The axles of the locomotive pass through the hollow shafts on which the armatures are mounted. These shafts are connected to the axles by universal couplings which allow of a freedom of motion in all directions. Each commutator is supplied with four sets of brushes. The controlling device placed in the interior of the cab is a series parallel controller and contains all the latest improvements of this type of apparatus. The shape of the cab is of peculiar design as seen in the illustration. The interior is finished in hard wood and is fitted with sliding doors and windows so arranged as to permit of an unobstructed view in all directions. It is of sufficient size to give the motor-man sufficient room for handling the locomotive.

The air for the brake is supplied by a special electrical air compresser which also operates the whistles. The motor is similar to the N. W. P. motor in its appearance and is wound for a high speed. The normal speed of the armature shaft is 675 revolutions. The dimensions of the air compressor are length 41 inches, width 16½ inches, height 25 inches. A special rheostat is provided for controlling the pump motor which is automatically controlled through an intermediate device by the air pressure. This locomotive was built at the Lynn shops of the General Electric Company. Visitors to the Fair will undoubtedly be very much interested in inspecting this locomotive being the first of its kind and designed for a new field of electrical transportation.

New Knowles Cleat.

A new porcelain cleat possessing several important features has recently been placed on the market by C. S. Knowles, 7 Arch St., Boston, Mass. The cleats are made of the best porcelain and in such a way that the cleats are of an even and uniform size and shape. The cleat is in two parts, both parts exactly alike, so that so long as there is more than one piece left there is a complete cleat. All annoyance attending the sorting of pieces is thus avoided.

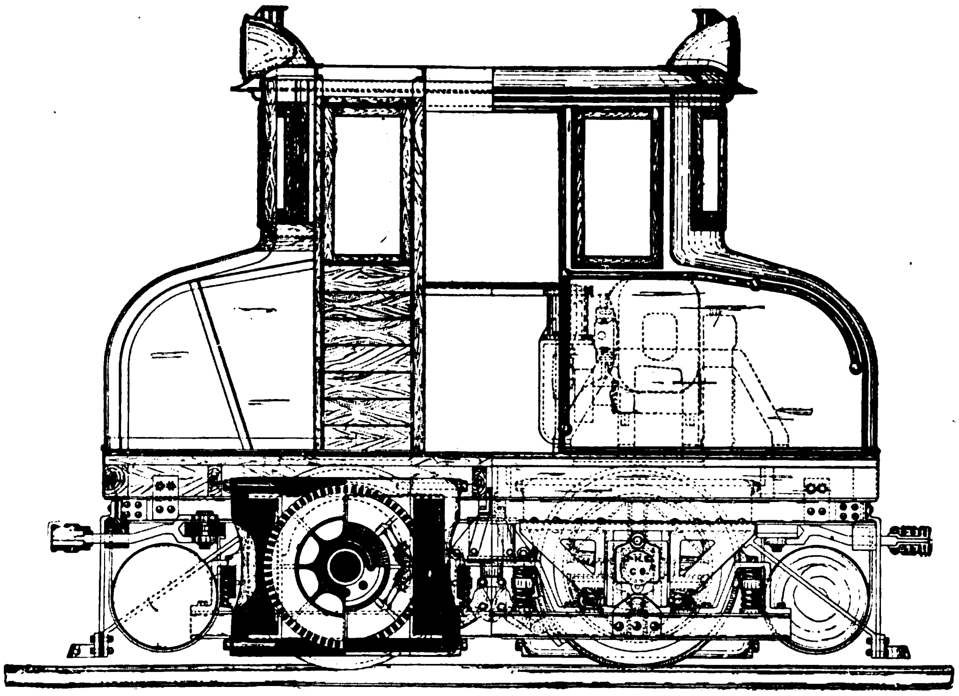


NEW KNOWLES CLEAT.

The cleat is durable, being well made and saves a large amount of trouble. The corrugated grooves hold the wire firmly and safely. The use of a porcelain for fastening electric light wires, and especially of porcelains that hold the wire out from the wall or ceiling is to be commended. This cleat possesses these advantages, making its use desirable when a more perfect insulation is desired.

The Genett Air Brake.

An exhibit in the Transportation Building at the Exposition of particular interest to street railway people is that of the Genett Air Brake Company. It consists of a Taylor Electric Truck Company's street car truck, equipped with a General Electric Company's W. P. motor and a complete set of the latest pattern of the Genett air brake.



A THIRTY-TON ELECTRIC LOCOMOTIVE.

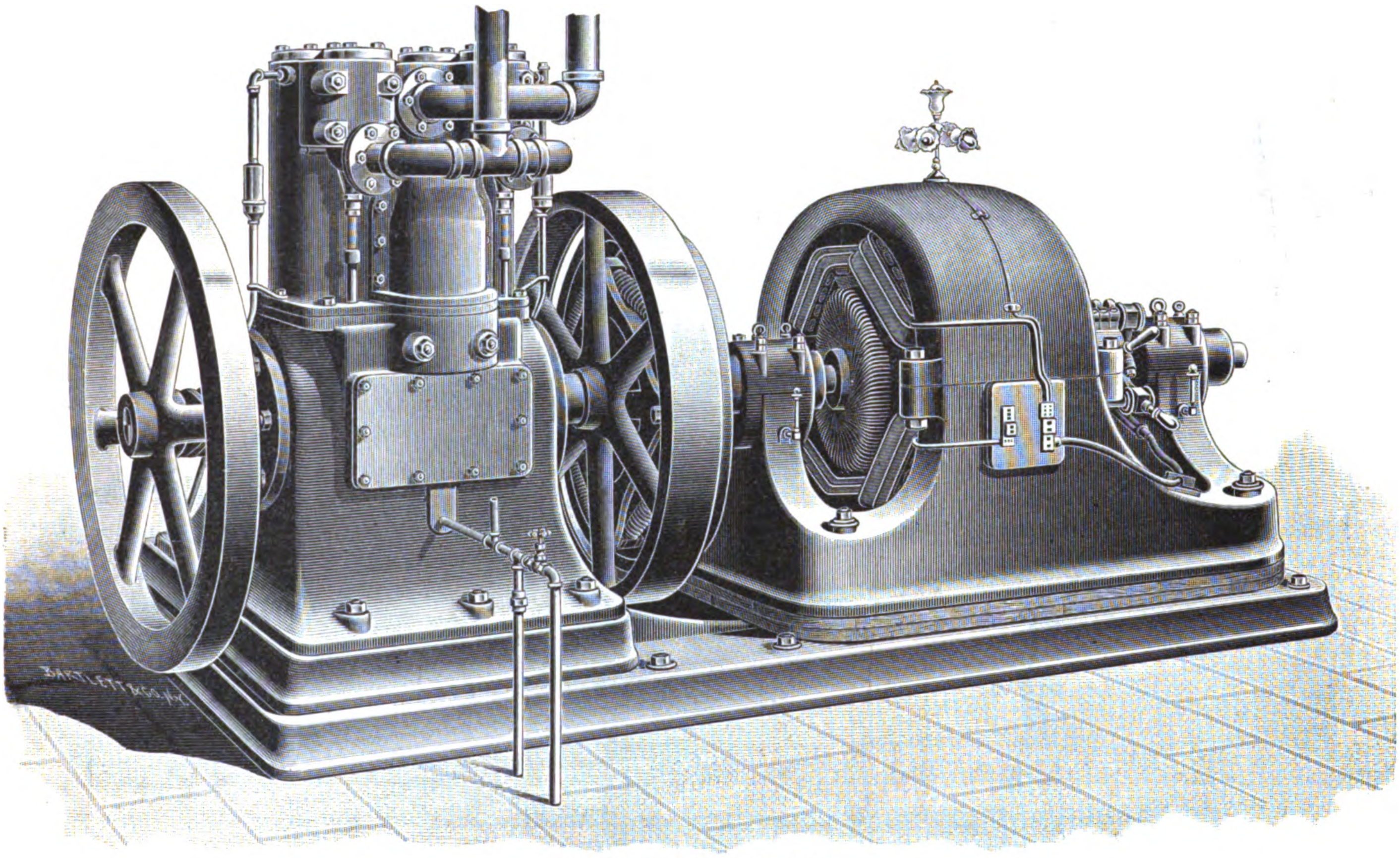
The brake consists of an air pump or compressor suspended from the truck frame and actuated by an eccentric on one of the axles. The bearing for the eccentric strap is turned spherically, so that the strap and eccentric can accommodate themselves to any movement of the axle, due to inequalities of the track or any other cause. To prevent wear on the eccentric it is completely enclosed in an iron casing attached by a ball and socket joint to and forming part of the pump cylinder. Thus all dust and dirt are excluded. The casing is filled with oil, affording complete lubrication for all parts.

The pump has a special form of controlling valve which lifts the suction valves from their seats and allows the pump to work freely as soon as a certain pressure is reached in the reservoir cylinder. The pressure in the reservoir cylinder is usually 30 pounds per square inch. Placed under the car or in some other convenient place is the reservoir cylinder, but in addition to it, which is one of the distinguishing features of this equipment, is the equalizing cylinder placed on the truck. The operation of the brake is as follows: Soon after the car has started both cylinders have been filled to the standard pressure; the governing valve has opened the pump valves so that the pump is working freely. When the motorman wishes to stop he turns the controlling valve to "stop," as shown on the indicator. This movement first closes the valve between the reservoir and equalizing cylinders, then opens the valve between the reservoir and "jam" cylinder, the air rushes in and the brake is applied. In releasing the brake the motorman turns the lever back only far enough to close the valve between the reservoir and 'jam" cylinder. At the same time the "jam" cylinder is opened and the piston released. In this way the car starts with a full 30 pounds pressure in the equalizing cylinder in reserve; the pump is not required and the motor is not taxed at starting with the extra load.

When the car is under way, the motorman turns the lever farther back, opening the valve between the reservoir and equalizing cylinder; the pressure being thus reduced the pump valves are closed and the chambers stored to the full pressure. In case of many stops in a short distance, the reserve in the equalizing cylinder may be called on. The "jam" cylinder is similar to others made for railroad service; the piston is moved the entire length when the air is admitted from the reservoir. The controlling valve is of peculiar form, made to perform all the functions as stated above. When it shuts off the air from the reservoir to the "jam" cylinder it also releases the air from the latter, allowing the brake to fall back and the piston to return to its original position. The handle to this valve is removable only when in the position it occupies when the brakes are on; therefore, the motorman cannot leave one end of the car and go to the other with the handle without leaving the car safe from starting alone. The truck on exhibition is raised from the floor and the motor is supplied with current, so that the operation of the brake is fully shown.

The Pittsburgh Gas Engine.

In the accompanying illustration is shown a direct coupled 100-horse power gas engine and electric generator. It has been designed by Mr. Albert Schmid and Mr. J. Chas. Beckfield. These engines are manufactured by the Fuel Gas & Manufacturing Company, of Pittsburgh, in sizes varying from 1¼ up to a 200-brake horse power. As shown in the illustration they are of the upright type which has been adopted on account of the great economy in space and its peculiar adaption to certain improvements and also the growing demand for upright engines.


BARTLETT & CO. N.Y.

THE PITTSBURGH GAS ENGINE.

One of the most striking innovations in the construction of this engine is the use of a crank chamber to enclose the running bearings and the lower end of the cylinders. The chamber is filled almost to the shaft with a mixture of oil and water into which the crank shaft and connecting rod splash at every revolution, so as to completely deluge the bearings, piston and interior of the cylinder, thereby not only affording copious lubrication but also supplying a jacket to the piston. All these gas engines are built with two cylinders on a single shaft and by the employment of water jackets all abnormal heating is obviated. Each revolution made by the engine operates valves admitting the gaseous fuel alternately to one or to the other cylinder. As the period of admission is controlled by a positive action the crank shaft receives an impulse once each revolution, and the energy of that impulse is predetermined by an independent piston valve.

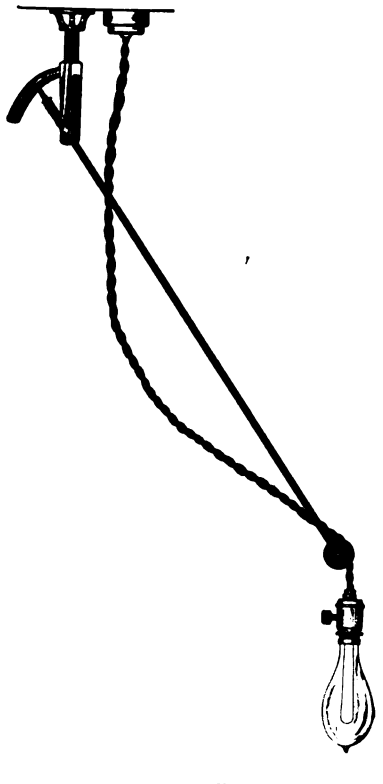
In order that the maximum amount of energy may be developed by the explosion of the gaseous fuel, there is but one value that the relative amount of gas and air can bear to each other. This value has been determined by a prolonged series of chemical analysis, and the Fuel Gas & Manufacturing Company now designs its measuring piston valves so that it shall always admit gas and air in the correct proportion for producing their maximum result, but at the same time vary the total amount of mixture directly as the work of the individual piston stroke.

An important departure in gas engine practice is disclosed by the Pittsburgh automatic governor, which both regulates the speed and controls the admission of fuel to the cylinder. It is mounted upon the shaft, between the cranks, and, by direct connection between the eccentric rod and valve stem, insures an accurate and positive travel to the measuring slide valve. The electric spark is employed in igniting the charge, and it is claimed to be the most desirable device, provided there is no uncertainty as to its regularity of action. The Pittsburgh patent sparker consists of an arm operated by a cam. At just the proper moment the arm is made to break an electric circuit, and the arc thus formed intensified by the use of an induction coil, ignites the fuel instantly. As the arm is actuated by a positive motion, there can be no failure to produce a spark and no failure in the resulting ignition of the fuel. In order that the engine may be entirely self-contained, the electric current is supplied from a galvanic cell. If preferred, however, the requisite energy may be taken from a dynamo circuit.

Each engine is equipped with a moderately heavy fly-wheel, a band wheel, where belting is to be used, the necessary gas bag, and all other minor but customary adjuncts.

Though entirely self-contained, yet by reason of its simplicity of design and the distributive arrangement of parts, each detail of the engine is at all times readily and completely accessible. All stop-cocks and faucets are conveniently arranged on one side, within an arm's reach of one another. The oil cups are supplied with a slight feed and so placed as to be easy of access. Both at front and at back the crank chamber has large openings through which the shaft, governor rods, etc., may be reached by the loosening of a bonnet. The interior of the cylinders is similarly easy to access. The head is made removable, thus allowing ingress for an occasional cleaning out of the dirt resulting from gas combustion. By such construction any part of the engine may be removed in a very few minutes, and with no other trouble than that necessitated by the unscrewing of a few nuts. All parts are built strictly to gauge, thus allowing complete interchangability.

Repeated tests of these engines made by competent and disinterested engineers show very efficient and economical results. In the rating of these engines, the brake instead of the indicated horse power is used; that is they are rated by the energy obtainable at the band wheel.



A NEW LAMP HANGER.

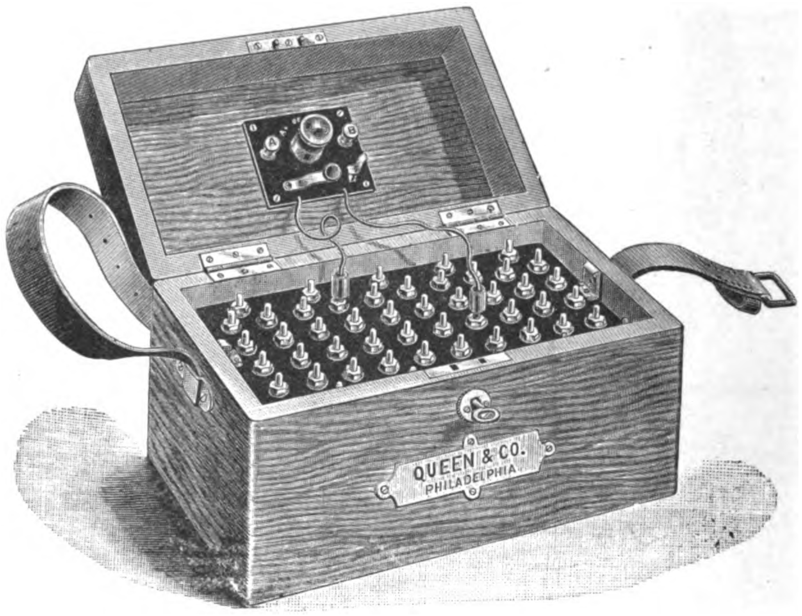
A New Lamp Hanger.

Bruce & Nutting, of 128 S. Clinton street, Chicago, have recently perfected a very convenient and useful hanger for incandescent lamps. It is especially useful in factories, stores and shops where it is desirable to change the position of the light from one place to another. It is well made with few parts and easily adjusted. The lamp is moved by the hand to the desired position where it remains securely in position. It can be adjusted to any position sidewise, up or down, within a circle of eight to ten feet. The hanger swings on a pivot that allows the lamp to be moved in a complete circle. The upper end of the rod on which the lamp is suspended is held in the notches in the bracket by the spring at any desired height. The simplicity of the construction together with the low price at which they are placed on the market (90 cents), will undoubtedly give them a large sale.

Aluminum Iodine Testing Battery.

Messrs. Queen & Company, Incorporated, of Philadelphia, have recently placed on the market an aluminum iodine testing battery of the design shown in the accompanying cut. It is a new form but has been thoroughly tested before it was placed on the market. In chemical composition the cell is quite different from anything heretofore used.

One of the most important features is the increase in the electro motive force of the cell which is one and four-tenths volts. This electro motive force largely exceeds that of the ordinary chloride of silver cell. When fifty of these are arranged in the battery the total electro motive force is 70 volts which is sufficiently great for any ordinary test. Batteries are arranged of any number of cells to suit the purchaser, as sometimes as high as two or three hundred volts is desired in a battery. These cells are prepared with great care, and those which have been used by Queen & Company in their own laboratory have shown remarkable constancy and long life. There is no danger of explosion from leakage and local action is practically eliminated so that when not in use there is no injurious waste.



ALUMINUM IODINE TESTING BATTERY.

The cells are mounted in handsomely polished mahogany cases. These same cells are used in the Acme portable testing set manufactured by Queen & Company, which contains twelve of these cells, and they have been so satisfactory that it is the intention to use them entirely in place of the chloride of silver cells.

Health Commissioner Homan will soon test the feasibility of an ambulance car on the street railways at St. Louis. It is reported that a trial car is already ordered and will be delivered on September 1st. The experiment will be watched with interest.

The Lain Electric Railway Trolley Appliances.

Several novel trolley appliances have recently been placed on the market by Messrs. J. H. Bunnell & Co., of 76 Cortlandt Street, New York. They are the invention of Mr. David E. Lain, of Yonkers, New York; after whom they are named.

In the accompanying cuts are shown Fig. 1, Lain's improved mechanical clamp for suspending the trolley. It is made of wrought iron and consists of two essentially similar parts, having on the lower edge a groove for the trolley-wire and also provided with two interlocking lugs. These lugs are of such shape that the harder the two pieces are forced together in a longitudinal direction, the harder the clamp are fastened together. The under edges of the clamp are so thin that no interference is offered to the passage of the trolley. The bolt that fastens the insulator on the top passes through both pieces affording additional strength to the fastenings. In Fig. 2, is shown Lain's improved non-sparking frog. The principle feature is the form of approaches to the frog which are extensions of the center floor of the frog and bent gradually upward. One of the flanges of the wheel strikes the approach and is forced gradually down until it passes the main floor of the frog which is beneath the trolley wire when it rises on a similar extention of the frog floor, until the wheel again touches the trolley wire.

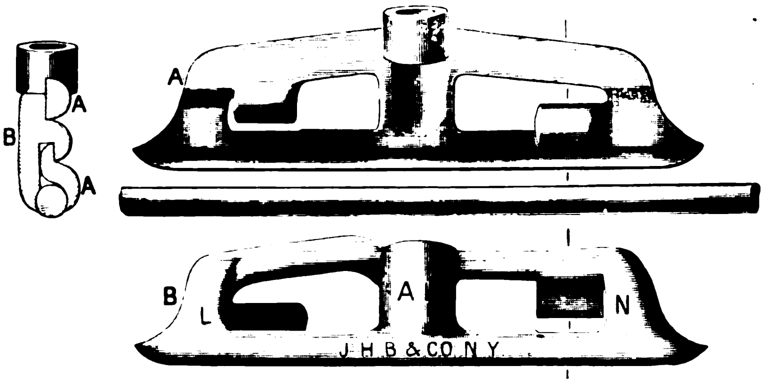


FIG. 1.

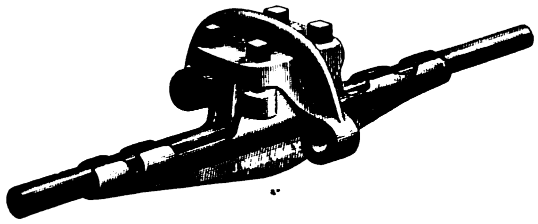


FIG. 5.

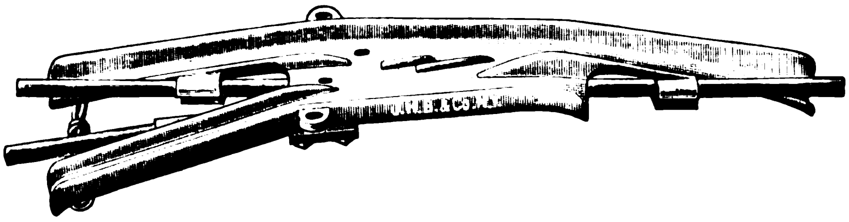


FIG. 2.

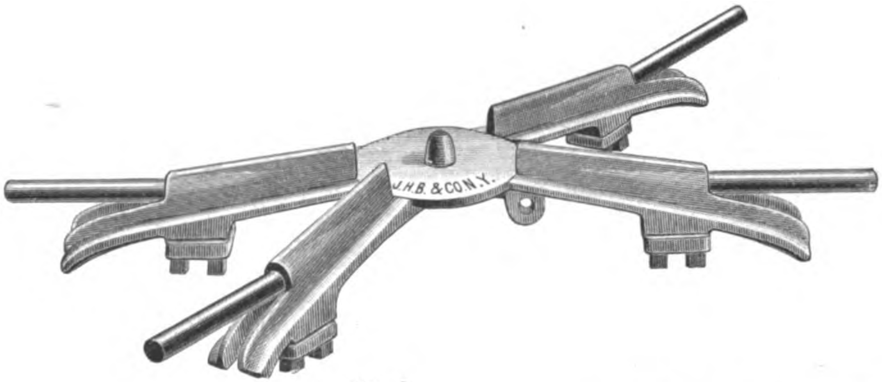


FIG. 3.

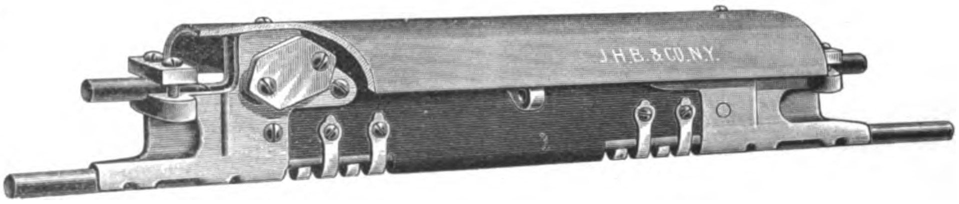


FIG. 4.

LAIN ELECTRIC RAILWAY TROLLEY APPLIANCES.

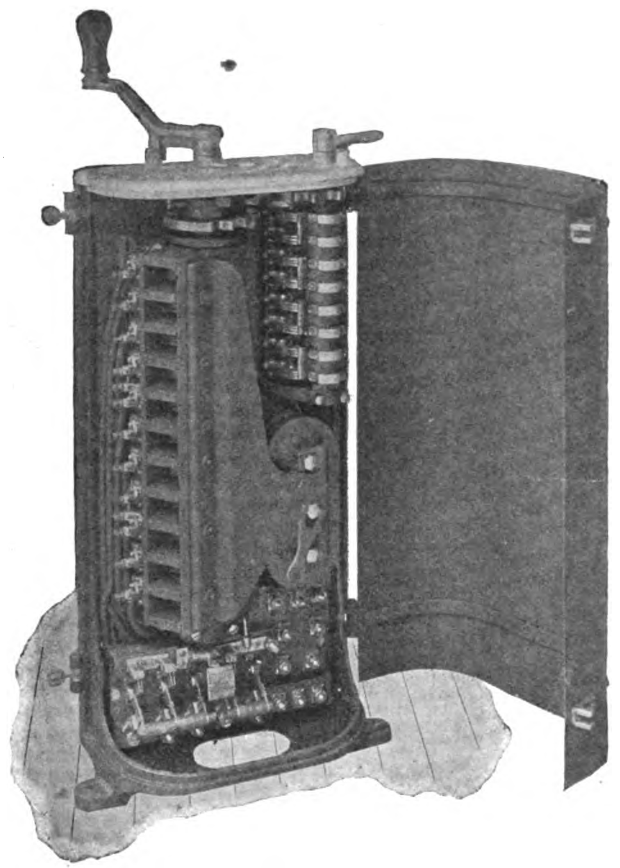
In Figs. 3 & 4, are shown Lain's new adjustable crossing which possesses the non-arcing qualities of the Lain frog, and Lain's section insulator. Its construction is briefly as follows: A large piece of fibre is provided at each end with suitable brass castings for fastening and holding the ends of the trolley. There are also a number of short brass blocks on the lower edge of the fibre block separated and insulated from each other. They are also insulated from the fibre block by mica washers in order to protect it from the injurious effects of the sparking—incident to the interruption of the current. The effects of the spark is consequently borne by the metal, rather than by the fibre.

Lain's screw clamp bridle and anchor ear is shown in Fig. 5. The brass ear is hollowed and in this deep groove the trolley wire passes and is held in place by a screw clamp, the cap of which has projecting arms bending downward as low as the trolley wire. The guy wires are attached to these arms and the strain does not deflect the wire from its horizontal position. The method of fastening the bridle permits it to be quickly put up and easily lowered if desired.

A New Controller.

The ease with which a car starts and the freedom from jerks in starting and stopping depends largely on the controlling devices. The General Electric Company has perfected a new type of controller, known as type K, in which are embodied the latest improvements. It is shown in the accompanying illustration.

The case contains with the regulating device, the connecting board, motor cut out, switches, and reversing switches. Rods and bell cranks are entirely eliminated so that no reversing parts are necessary below the floor of the car. All contacts are well insulated and the tendency to arc on making circuit is prevented by means of the magnetic blow out which deflects the arc sidewise from the segments and spring contacts and extinguishes it. The reversing switch is in general design similar to that of the controller, the segments being carried on a small cylinder and making contact with spring fingers. By the movement of the reversing lever through 60 degrees the combination of the armature leads of both motors and reverses the motion of the car.



A NEW CONTROLLER.

The motor cut out switches which are attached to the connection board of the controller, permit of rapid and absolute disconnection of the motor from the circuit. The value of such an arrangement in case of the disablement of the motor on the road will be appreciated by railway men. By loosening two thumb screws on the outer case the case may be opened and by the removal of a bolt in the pole pieces it can be swung back, giving access to all parts of the controller. Care has been taken in the construction of this controller to secure ease and smooth operation. The motor man is enabled to make exact and perfect contacts by the pointer on the dial which is thrown by a wheel attached to the upper part of the cylinder shaft and actuated by a spring into the notch on the dial.

By means of an interlocking device between the reversing switch and controller, the operation of either, unless it is in proper relation to the other, is impossible. The reversing switch cannot be moved over unless the controller is in the "off" position, nor can the controller be operated while the switch is between its forward and reverse positions. Another ingenious device ensures the proper adjustment of the motor cut-outs, thus, when one motor is cut out, the combinations of the other alone can be made. This arrangement prevents all liability to injury of the motors through wrong connections.

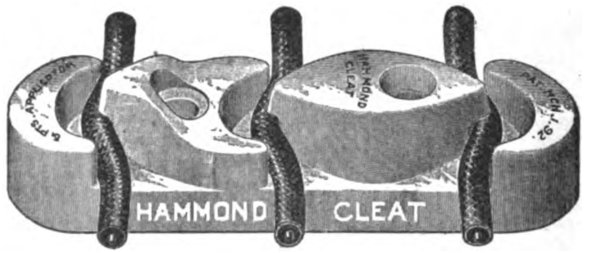


FIG. 2.—THE HAMMOND CLEAT.

The Hammond Cleat.

In the accompanying cuts are shown varieties of the Hammond cleat. They are manufactured by the Hammond Cleat & Insulation Company, of 15 Custom House St., Boston. The different styles are adapted to one, two and three wires, and can thus be used to advantage on any system and in all parts and places on that system.

The cleats are all made of one piece of fine quality of porcelain and special care taken to have them perfect in shape and the screw holes clear and regular. It furnishes an easy and quick way of wiring and saves the inconvenience attending the use of tie wire, and also saves a considerable material otherwise used. The cleat from the peculiar shape of the wire rests, holds the wire firmly without any danger of injuring the insulation.

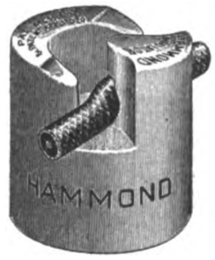


FIG. 1.

The one wire cleat, as shown in Fig. 1 is slightly different from the two and three wire cleats but the same principle is employed. It is intended for use with arc wires or single wiring of any kind. The ease with which the wire may be run with these cleats is worthy of more than passing notice. The cleats are fastened in place before the wire is adjusted so that both hands are free for the drawing of the wire and fastening in the cleat. This fact will be appreciated by those who have had experience with other methods of wiring requiring the wire to be drawn and held while one hand is encumbered with the necessary tools for fastening.

The importance of electricity and the interest manifest in it by the general public is shown by the attention given the subject by the monthly magazines. The Review of Reviews for July contains an article by Mr. J. R. Cravath on "Electricity at the World's Fair," and under the heading "Two Giants of the Electrical Age" appears a sketch of Thomas A. Edison by Mr. Chas. D. Lanier, and a sketch of Sir William Thomson, Lord Kelvin, by J. Munro. The whole occupies some 28 pages. Electricity has become so thoroughly a part of the every day life of the people and its applications are so numerous that its development is of universal interest.

The Thompson Smokeless Furnaces.

Considerable attention has been given recently to the construction of smoke consuming devices and the building of furnaces which will entirely consume the fuel. In securing the complete combustion of the fuel it is also desirable to secure the proper effects of this combustion, in the utilization of the heat generated. In the accompanying illustrations are shown several applications of the principles worked out by J. Knapton Thompson, C. E., of Leeds, England, for securing the complete combustion of fuel and the consequent absence of smoke.

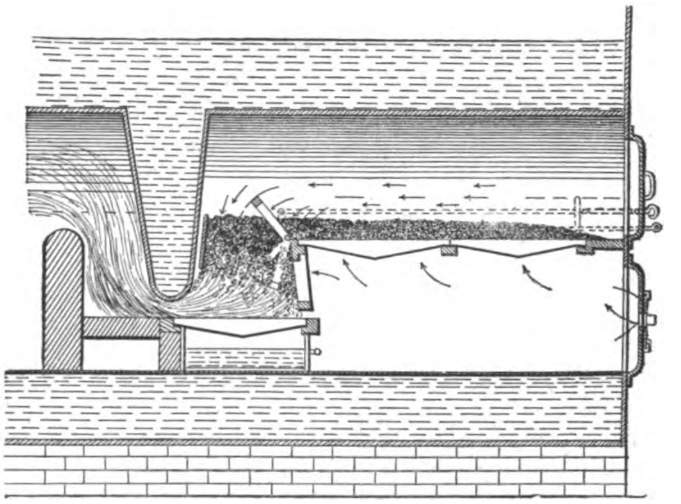


FIG. 1.—THE THOMPSON SMOKELESS FURNACES.

In Fig. 1 is shown the general construction of the furnace and boiler of the rear hand feed type. The various entrances for the air is illustrated by the arrows. In Fig. 2 is shown the construction of the front automatic feed fire box and the operation of the down draft furnace.

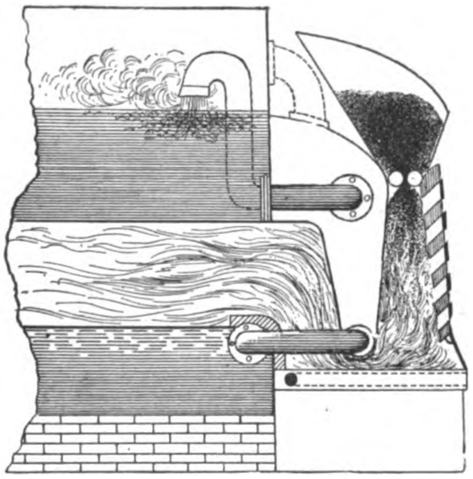


FIG. 2.—THE THOMPSON SMOKELESS FURNACES.

These furnaces have been used for some time in England, but have only recently been introduced in this country. They are down draft, and the fire-box is so arranged that the fuel is continuously distributed in a finely granulated ram-like feed. The air supply is so adjusted that the gases arising from the coal are supplied with a sufficient amount of air for complete combustion before reaching the temperature where they ignite. By this arrangement the gases are consumed and the boiler tubes are not covered with soot and other substances preventing the penetration of the heat.

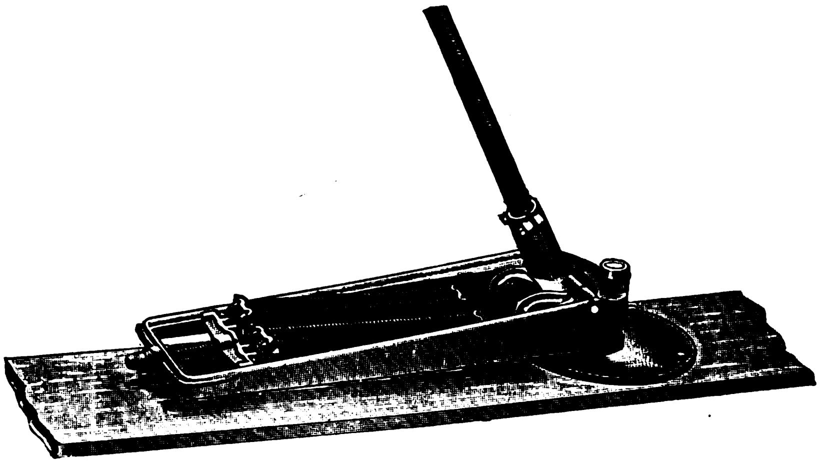
In ordinary types of boilers the overheating of plates is largely caused by the manner in which the steam is released from the water. It is well known that when the plates or tubes become hot they impart the heat to the water above them until small bubbles of steam are formed which rise upward and pass through the water into the steam space. In their passage upward they leave behind whatever solid matter they may have contained and are at the same time impregnated with moisture. In the Thompson smokeless furnace the water in the boiler must pass through the lower pipe into the inverted bridge at the back of the fire box and thence through the upper pipes to the crown of the boiler. This enables the heat to be taken up more rapidly by the water and a consistent movement of the water through the bridge prevents the deposit of scale and there is no possibility of the water being still or dead in any part of the boiler. Besides this on reaching the crown of the bridge the steam is liberated without passing through the water and there remains practically dry steam in the steam space. The more promptly the heat of combustion can be taken up by the water the more efficient is the evaporation in the boiler and the heat is more rapidly transmitted and good circulation maintained. The Thompson system of smokeless furnaces has taken advantage of these ideas in the construction of its system.

The same principles are applied in the construction of grates and ranges for domestic use. In this application a larger amount of the combustable matter in the fuel is utilized and the dust and dirt attending the use of the ordinary stoves are in a large measure absent.

These furnaces are manufactured by the Thompson Smokeless Furnace Company, 103 & 104 Hamilton bldg., Pittsburgh, Pa.

The Pivotal Boston Trolley.

The Boston trolley, manufactured by Messrs. A. & J. M. Anderson, of Boston, has been on the market for some time and its good qualties well known and appreciated. The Pivotal Boston trolley, is a trolley recently perfected and placed on the market by the same firm and while it combines the good qualities of the former it possesses several very important and novel features. The lower frame of the trolley as shown in the accompanying cut is hung on a pivot that enables the trolley to swing clear around on the car. The entire base, pole and fork is made of steel. It is neat, light and strong. It is very compact and when the trolley is laid down horizontal, the highest point is but six inches above the top of the car. The springs and manner of adjusting is the same as on the Boston Trolley.



THE PIVOTAL BOSTON TROLLEY.

The Nutting Arc Lamp.

The Nutting arc lamp, manufactured by the Nutting Electric Manufacturing Company, for whom Bartholomew, Stow & Co., of 57 Michigan street, Chicago, are general sales agents, is illustrated in the accompanying cut. In construction it consists of a ring of wax-like material, two and one-half inches in diameter, mounted between two ebonite discs on a shaft which is geared directly to the upper carbon rod. A metal pin is mounted on a stationary holder in such a manner as to have one end embedded in the surface of the wax one-eighth or three-sixteenths of an inch, the cross section of the ring being about one-half by one-half inches. The remaining surface of the pin has wound on it fine German silver wire of 150 ohms resistance, which, with an additional resistance of about 600 ohms, forms the shunt or feeding curcuit of the lamp.

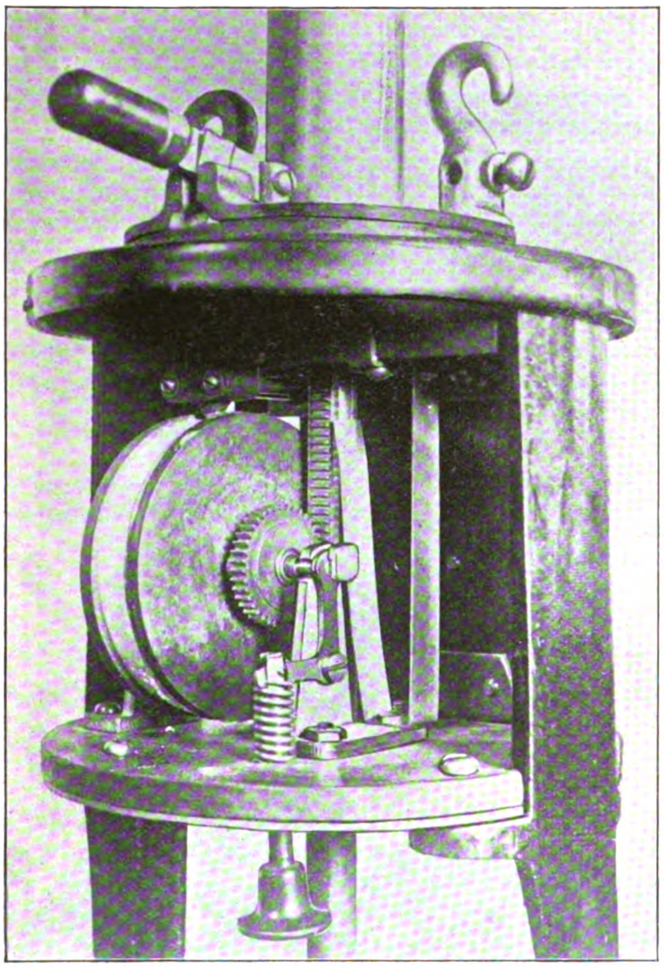


FIG. 1.—THE NUTTING ARC LAMP.

It is evident that with the pin imbedded in the wax that the carbon rod is held rigidly in place; but on the separation of the carbon points the shunt circuit will at once take its share of the current, the proportion depending on the voltage at the terminals of the lamp, i.e., the carbon points. The metal pin at once becomes heated by the passage of the current through the resistance wire wound around it, the neating effect varying with the square of the current passing through the shunt circuit. As the pin heats it melts the wax-like material in which its end is embedded, and allows the ring to slowly revolve on its shaft, thus feeding the upper carbons and maintaining the arc at a uniform length as the carbons are consumed. The melted material of the ring at once solidifies behind the pin leaving a perfectly smooth and even surface for the next revolution.

In actual service it is found that the movement of the slowly revolving ring is so uniform that it is practically impossible to detect any movement whatever, and that the carbon is being constantly fed forward at the exact rate at which they are being consumed.

The feeding mechanism being entirely devoid of magnets or other inductive mechanism and depending on a principal extremely more sensitive to current fluctuations than any combination of magnets, makes it possible to attain in an arc lamp, a simple and perfectly constant feed, the perfection long sought for by those engaged in perfecting feeding mechanism.

The alteration of adjustment necessary for extreme change of temperature has been thoroughly worked out and is accomplished in an extremely simple and positive manner. The cutouts are all mechanical and cover all possible cases in which they may be called into use. Cutout magnets are not used, thus doing away with what is often a never ending source of repair.

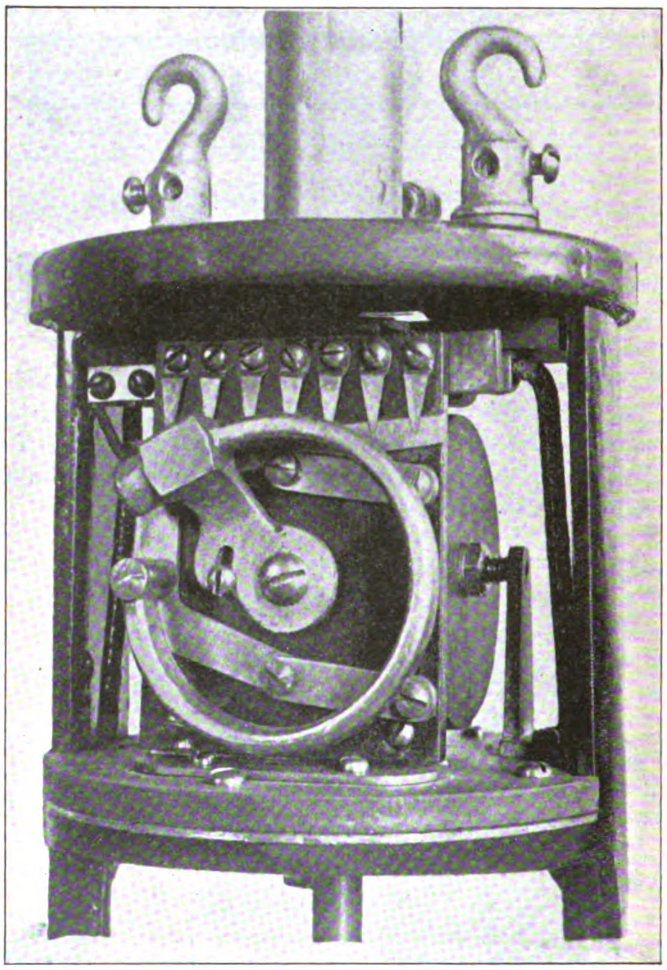


FIG. 2.—THE NUTTING ARC LAMP.

The carbon holders, globe holders, etc., are all designed to facilitate trimming and inspection, and the completed lamp, weighing 16 pounds, presents a neat and practical appearance.

Meeting of the Northwestern Electrical Association.

The meeting of the Northwestern Electrical Association, as announced in our last issue, was held at Madison, Wis., July 19th and 20th. A number of interesting papers were read by Prof. D. C. Jackson, George Cutter, H. S. Putnam, H. C. Thom and others. While not large, the attendance and enthusiasm were encouraging for the future of the Association.

An Automatic Short Circuit Bell.

AUTOMATIC BEL
OFF
ON

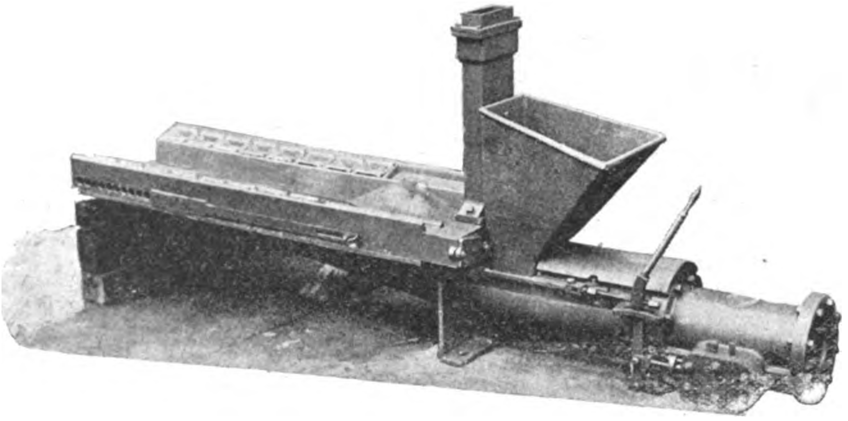
The accompanying cut shows an automatic alarm bell, manufactured by A. L. Bogart, 22 Union Square, New York, for the detection of grounds or short circuits on battery circuits. It requires no batteries, nor special wiring. The bell never rings unless the circuit has been closed for more than a fixed period. Its time of operation can be varied from one to 20 seconds, by means of the set screw. Normally, the bell is not in the circuit. If the battery becomes grounded for a greater length of time than the adjusting screw is set for, then the bell is cut into the main circuit and rings until the trouble is removed or disappears, when it cuts itself out again. It is especially adapted for use on electric gas lighting circuits, to which it is easily attached. The main gas lighting circuit is cut at any convenient place and the two ends connected in the binding posts on the side of the bell. This alarm bell combines in itself all the features of the detached relay, local bell and battery, without the expense of the latter two. While the bell is ringing its resistance and counter electromotive force cut down the current to so small an amount that the consumption of current and consequent deterioration of the battery is very small.

The Jones Under-Feed Mechanical Stoker.

An exceedingly efficient mechanical stoker is shown in the accompanying cut. The method is entirely new and the principle of under-feed possesses many advantages of efficiency and economy. In this arrangement the fresh coal is always covered with a bed of incandescent coke the heat from which generated the gas from the fresh coal which as fast as generated is consumed while passing through the bed of incandescent coke.

In starting the fire in these stokers the retort is first filled with coal level with the top of the tuyere pipes. Fire is then started on the side grates as usual until steam is raised. The ash pit doors admitting air to the side grates are then closed. Coal is then placed in the hopper and when filled the steam ram is then withdrawn by shifting the latter. The desired quantity of coal then falls from the hopper in front of the ram and upon the return stroke is forced into the retort. Air under pressure is then admitted into the suyere pipes. This air issues through the slots shown in the illustration over the top of the fuel in the retort but under and through the burning fuel. The result is that the heat from the burning fuel slowly liberates the gas from the fuel in the heater. This gas being thoroughly mixed with the incoming air before it passes through the burning fuel above results in a bright clear fire free from smoke and the complete consumption of all the heat producing elements in the coal takes place. It being seldom necessary to open the doors, the draft is entirely from the tuyere pipes. The retort being practically air tight from below, the combustion takes place over and above the air slots, hence the castings of the retort remain cool and not subjected to the severe action of the furnace fire. The air is supplied by means of a blower driven by an independent engine.

The method often employed of admitting a large amount of air to the furnace grate often results in the loss of a large amount of heat owing to the cold air thus admitted, absorbing a large amount of heat. This cold air also coming suddenly in contact with the heated boiler plates and tubes often causes great injury while its effect in reducing the amount of smoke is only momentary and very unsatisfactory. The Jones Under-Feed Mechanical Stoker is manufactured by the Jones Furnace Company, 506 Bort bldg., Chicago, Ill.



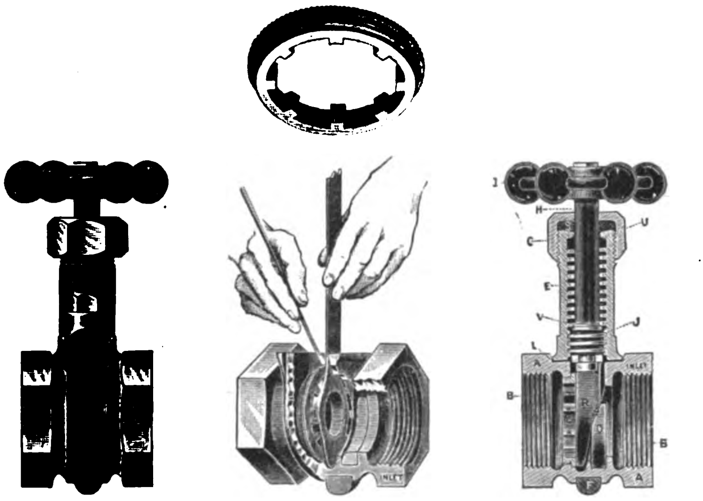
THE JONES UNDER-FEED MECHANICAL STOKER.

The Lunken Gate Valve.

In few industries has there been less genuine invention displayed for many years than in the valve making industry, for the valves of today are much the same as were used years ago. The ordinary globe valve, on account of its crooked and cramped passage, is not a perfect valve, causing a loss through resistance. Users of valves realize this fact, which accounts for the increased use of straightway or gate valves.

The Lunkenheimer Company, of Cincinnati, O., whose many specialties are well known, have added to their popuspecialties the Lunken gate valve, which will be appreciated by valve users as it possesses several important improvements. It is an almost complete departure from the usual pattern, being simple, compact, durable, and possessing the advantage of being a straightway valve. To get an idea of the compactness of this valve it is worthy of mention that a one inch valve (warranted to stand fully 150 pounds working pressure) weighs three-fourths pounds.

The hub or bonnet is held to the shell with its end passing through the ears of the bonnet, and secured by nuts. This clip is held from lateral movement by projections on the shell. The joint is packed by a hard lead washer, of one-sixty-fourth inches thickness, the top faces of flanges each having a groove, to properly secure the washer. The valve can easily be taken apart without renewing the packing washer. The hub or bonnet is flat and narrow, and just of sufficient size to receive within it the valve disk when entirely raised, and has sectional or part-nut threads in its opposite interior sides. The threaded portion of the stem by engaging with these part threads, causes the valve to be opened or closed. The disk has a straight flat face or bearing against the renewable seat and is forced tightly against same by the self-adjusting wedging half-ring, or horseshoe secured loosely in the valve shell. The wedging on the disk is applied on two wedging surfaces, diametrically opposite each other, these coming in contact with the beveled ends of the half-ring or horseshoe wedge; thus the wedging is properly equalized on the entire disc and insures a tight joint on the opposite face. The pressure of the steam or liquid on the back or wedge side of disk also aids to make a tight closing valve. All valves above two and half inch size are provided with "by pass."



THE LUNKEN GATE VALVE.

The renewable seat, it will be seen by referring to the cuts, is an exteriorly threaded flanged ring that screws against a face or shoulder of the flange, the opposite side of which flange forms the seat or bearing surface for the disk to close against. The inner periphery of the ring has lugs or teeth for the engagement of the wrench as seen in cut, by which means, after taking off the bonnet, the seat is operated, and either taken out or put in through the disk opening of the body without disturbing the connection.

It is impossible for anything to lodge on the seat of this valve, because the disk and seat have a parallel straight face, and as the pressure on the back of disk keeps it tightly pressed against its seat, it actually cuts away (like the action of the blades of a pair of shears) anything in its path.

This ingenious and simple valve is the invention of Mr. Edm. H. Lunken, whose reputation is already established, by the specialties manufactured by the Lunkenheimer Company of Cincinnati, Ohio.

The P. & S. Outlet Insulators.

Where wiring is done for outlets adjoining gas pipes, it has been found difficult to get proper insulation at this point. The wires are apt to be displaced by the lathers and plasterers and leakage may occur between the wire and the gas pipe with which it is in contact. Then the inspector who cannot see the work under the plaster is is puzzled to locate the ground.

To overcome these difficulties, Pass & Seymour of Syracuse, N.Y., have devised two methods of insulation at the outlets. One consists in using small curved tubes made of tough china, which, when fastened to the gas pipe with tape, insulate the wires from both the iron pipe and the plaster. The china tubes will not bend out of shape like those made of fibre or rubber, nor will they deteriorate with age.

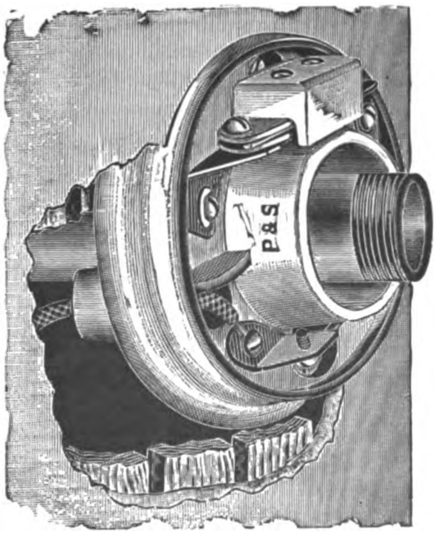


FIG. 1.—THE P. & S. OUTLET INSULATOR.

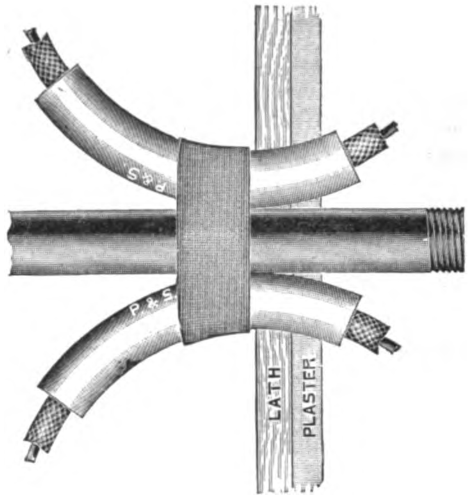


FIG. 2.—THE P. & S. OUTLET INSULATOR.

Where a cutout is wanted at the outlet, the outlet insulator shown in the cut is a very serviceable device. This is fastened direct to the lathing and projects slightly beyond the plaster. The wires pass through the holes in the china, so that they cannot possibly touch the iron plate. The cutout part can be fused with special plugs as in the cutout or with the plain fuse wire. It takes the place of the horseshoe or bug cut-out, is more firmly fastened to the ceiling and more easily fused. It ought to prove a useful fixture for all kinds of concealed wiring. This as well as the small china tube is handled in the west by George Cutter.

A BRIEF REVIEW.

Mr. E. J. Edwards says in McClurg's Magazine; that, "When Mr. Edison was asked about his campaigns and those achievements by which he measured his life, he said that in the past there had been first the stock-ticker and the telephone, upon the latter of which he worked very hard. But he regarded the greatest of his acheivements, in the early part of his career, as the invention of the phonograph. 'That,' said he, 'was an invention pure and simple. No suggestion of it, so far as I know, had ever been made; and it was a discovery made by accident, while experimenting upon another invention, that led to the development of the phonograph.'

" 'My second campaign was that which resulted in the invention of the incandescent lamp. Of course an incandescent lamp had been suggested before. There had been abortive attempts to make them, even before I knew anything about telegraphing. The work which I did was to make an incandescent lamp which was commercially valuable, and the courts have recently sustained my claim to priority of invention of this lamp. I worked about three years upon it. Some of the experiments were very delicate and very difficult. Some of them needed help which was very costly. That so far has been, I suppose, my chief achievement. It certainly was the first one which made me independent, and left me free to begin other campaigns without the necessity of calling for outside capital, or of finding my invention subjected to the mysteries of Wall street manipulation.' "

The present status of the gas engine in electric lighting is thus stated in a recent number of the Electrical Engineer:

"Not a few such engines are already in use in central stations, where, as a rule, the electric plant is an adjunct to a gas plant, but for isolated electric lighting the gas engine has made but comparatively little progress. It seems opportune therefore to inquire into its present status, and to consider some of the more recent developments with a view to ascertaining the direction of its probable future in this field.

"In some estimates recently made by Professor Kennedy it was shown that the engine room cost per unit (1,000 kilowatt hours) generated by the Westminster Company in London was 2.2 cent. Almost simultaneously with this announcement we are given the results of an experiment extending over two years made in order to determine the cost of electric lighting with dynamos driven by gas engine in an isolated plant. The result showed that with gas at 68 cents per 1,000 cubic feet, the cost of gas was 2.2 cents, per unit generated, while the total cost, including attendance, interest and depreciation came to 6 cents per unit, which showed a saving of over 12½ per cent per annum. While the latter result leaves no doubt as to the economy of the gas engine in isolated plants even at the present cost of gas, the apparent disparity in the cost shown between the isolated plant and that of the central station per unit is easily explained when we consider the difference in the cost of gas to the consumer and its actual cost of manufacture. It goes without saying that a large central station operating gas engines would have its own gas generators, and with the present improved methods, it is claimed, producer gas can be manufactured at less than 10 cents per 1,000 cubic feet. Under these conditions the reduced cost of gas would bring down the figures close to those of the steam plant. But while this may still be considered as a problem for the near future, the immediate application of the gas engine to sub-station work is receiving attention and we note as significant the recent installation of four gas engine sub-stations in Liverpool, in preference to converter sub-stations.

"The most recent progress in gas engine economy, which it is claimed, brings down the gas consumption to 13.2 cubic feet per indicated horse-power per hour, must also act as a powerful influence in gaining for this type of prime mover a more general recognition as an adjunct to electric generating apparatus. While as yet the large power units now being adopted have not been carried out in gas engine work, the tendency towards increase in the size of the latter is a constant one, and while 200-h. p. may be considered large for a gas engine unit to-day, it by no means follows that such will be the case five years hence. On the other hand, the instances in which units greater than this can be economically employed, form but a small minority still in central station work. Taking into consideration all these factors, therefore, the outlook for the gas engine in electric lighting seems favorable to its most general adoption, and we shall look forward with much interest to the experiment above cited about to be undertaken in Liverpool.

"The remarkable result in gas engine economy above referred to, it is gratifying to know, is due to Mr. Albert Schmid, whose genius as a designer is already indelibly stamped on American dynamo electric machinery and whose ability as an engineer should leave little doubt of the future success of his latest improvement in engines for driving electric generators."

The magnetic pulley method of transmission as recently tested on the Camden street railway is described by Mr. W. E. Harrington in a recent number of the Electrical World. This road is equipped with single Westinghouse motors and the manner of applying the above method is described as follows: " At certain times, owing to loads, trail cars and condition of track, the wheels of the motor cars 'skid;' to overcome this two magnetic pulleys were made, both the same size, 18 inches diameter, four inches wide, and also a flexible iron belting three and three-eighth inches wide. One pulley was placed on the motor axle beside the motor, and the other pulley was placed in line on the dead axle.

"The method of electrical connection being simple, it is easily followed; instead of grounding the motor current direct, the ground terminal of the motor circuit is led to a rubbing contact on the dead axle, thence to one terminal of the magnetizing coils on the dead axle magnetic pulley; the other terminal of the magnetizing coils is attached direct to the rim or face of the pulley (which is insulated from the hub) and the current follows across the belting to the face of the pulley, which in this case is the ground. This arrangement of circuits enables us to do away with rubbing contacts on the motor axle, which otherwise would be troublesome. Since the windings are in series with the motor the magnetic attraction increases directly with the current. When the current is applied to starting the car the magnetic pulleys have their maximum magnetic adherence, and the car wheels which would otherwise skid are now reinforced by the additional traction afforded by what would otherwise be dead wheels, requiring additional power on the part of the motor. The amount of energy required to develop the magnetism is almost negligible; in the test as made the maximum voltage across the terminals of the entire pulley circuit did not at any time exceed 12 volts, which need not be considered in the case of a 500-volt circuit.

"In point of fact this question of the consumption of energy to obtain additional traction assumes a new and interesting phase, as in every other form of device heretofore suggested and tried the arrangements cause a certain amount of loss which is a constant factor and militates seriously against them. The only time when a car requires additional traction is chiefly upon starting and when climbing grades; if at all other times the device, which is intended really only to assist in starting and on grades, could be simply disconnected and thrown out of service unquestionably a great saving in energy would be effected, which with a large number of cars and covering any period of time, say a year, would result in a very material saving. Unless this disconnecting device is simple it had better not be used on the score of the multiplicity of parts. For instance, if bevel gears were used, the only device that could be used to detach and throw one out of service would be a friction clutch; any comment on the disadvantages of such an arrangement would be superfluous.

"In the combination as embodied in the magnetic pulley method of transmission all that is necessary to throw the same out of operation is the mere making or breaking of its circuit. Since magnetic pulleys and belting do not depend upon mechanical friction for transmission of force the belt need not be under tension and the face of the pulleys may be lubricated if desired."

FINANCIAL.

The past month has seen a continuous depression in stocks and all securities.

Reports that confidence was again restored have been frequent in the daily press, but continued failures have not confirmed them.

Money has been obtainable at reasonable rates on call and short time loans, but commercial paper has been exceedingly hard to discount.

Owing to continuous and heavy withdrawals of deposits many banks have been compelled to close their doors, but most of them will doubtless reopen as soon as permitted by the Comptroller of Currency.

Very few shares of electrical stocks have been traded in excepting General Electric and Westinghouse. Of the former about 300,000 shares have changed hands and at prices varying from 72 down to 30½, the latter price being quoted on the 29th.

Westinghouse stock has not fallen as much in proportion to its par value, but is very low for one on which very heavy net earnings are claimed for the past four months. Fort Wayne Electric has decreased but little, there being little trading in it. Street railway securities still hold their own very well, having dropped but little.

Bell Telephone is considerably lower, also Western Union, which a few months ago was selling close to 100 and is now ruling around 68. The reports from stock centers show that many orders for small blocks of stock are being received and that stock so bought is in every case for investment and will not again be on the market.

Rumors were floating about during the latter half of the month that a receiver had been asked for General Electric, but this like other similar rumors was met by a prompt and vigorous denial. The lamp decision at Milwaukee seems to have had absolutely no effect on the price of this stock, as the fall in price has been steady ever since.

Below are a few comments from the financial press:

The New York *Telegram* says that "there are serious differences in the General Electric Co. between the old Thomson-Houston and Edison General Electric factions. Before the consolidation General Electric paid particular attention to construction work, and Thomson-Houston to manufacturing. Of late considerable money has been lost in construction work. This line has been radically reduced. For example, the force in the New York branch has been reduced from 200 to 30 employes. Against 12 solicitors for construction, there are now only two. This is true of other sections. This policy gives rise to the belief that the Thomson-Houston faction is dominating the management and that the result will be a complete stoppage of construction work, and that the entire attention of the company will be confined to manufacturing of apparatus." A banker is quoted by the Wall Street *Journal* as saying: "I know that an examination of General Electric affairs has just been made and that it showed the company to be all right. I look upon this selling today as the end of a liquidation which has been going on for weeks."

The earnings of the Westinghouse Electric and Manufacturing Co. for March, April, May and June, 1893, were in excess of of $1,000,000 net. This may perhaps explain the continuous inside dumping of General Electric stock; the selling by that company of its gilt-edged treasury securities, and the cutting down of salaries.—*Wall St. News.*

The Chester Light, Water & Ice Co. of Chester, Ill., are offering 6 per cent first mortgage gold bonds for the increase and improvement of its plant.

The company has an exclusive 25 year franchise from the city. The electrical apparatus is being furnished by the Brush Electric Co. of Clevelaud, Ohio. J. D. Gerlach is general manager of the company.

NAME OF COMPANY.	DESCRIPTION OF SECURITY.	AMOUNT ISSUED.	PAR VALUE.	RATE INT.	DATE PAYABLE.	CLOSING July 28
Miscellaneous Securities.						
American Bell Telephone Co....	Stock.	$17,500,000	100	....	J. Q.	166
" " "	Bds. 1893.	2,000,000	100	7	F. & A.	109
American Tel. & Cable Co... ...	Com.	14,000,000	100	....	....	78
Commercial Cable Co	Com.	7,716,000	100	....	....	.....
Edison Elec. Ill. Co., Boston....	Com.	2,025,800	100	....	F. Q.	130
" " " ...	C.Bds. 1898.	71,000	100	6	M. & S.	.....
" " "	C.Bds. 1901.	586,500	100	6	M. & N.	.....
" " Brooklyn..	Com.	2,500,000	100	....	Q. F.	85
" " " ..	1st. 1940.	500,000	100	5	A. & O.	.....
" " " ..	Regis.	....	100	5	A. & O.	.....
" " Chicago...	Com.	3,000,000	....	8	Q. F.	.....
" " "		2,500,000	....	....	....	.....
" " New York.	Com.	7,938,000	100	....	Q. F.	98
" " "	1st 1910.	2,562,000	100	5	M. & S.	.....
" " Phila......	Com.	1,473,000	100	....	....	120
" " "		....	....	5	....	.....
Fort Wayne Elec. Co...... ...	Com.	4,000,000	25	....	....	8½
General Electric Comp ny.	Com.	30,457,000	100	....	......	42⅜
" "	Prf'd.	4,251,900	100	....	....	75
" "	Deb. 1922.	10,000,000	100	5	J.-D.	70
Gold & Stock Tel. Co...........	Com.	5,000,000	100	....	Q. J.	.....
Northwestern Gen. Elec. Co....	Com.	1,000,000	100	....	....	.....
" " "	Prf'd.	750,000	100	....	J. Q.	.....
Thomson Elec. Welding Co......	Com.	1,000,000	100	....	....	.....
Thomson Europ an Weldi g Co.	Com.	1,500,000	100	...	....	.....
Thom on-Houston Elec. Co . .	Series D.	120,000	10	....	......	.....
Thom'-n-Houst'n Intern.Elec.Co.	Com.	600,000	100	..	....	.....
" " " "	Prf'd.	400,000	100	....	....	.....
United Electric Securit'es Co....	Com.	1,000,000	100	....	....	.....
" " "	Prf'd.	1,000,000	100	....	F. & A.	....
Western Union Tel. Co..........	Com.	94,820,000	100	....	Q J.	67⅝
" "	Var. Issues	13,088,000	10	7&5	M. & N.	.....
West'gh'se Elec. & Mfg. Co	Ass'ting.	5,333,940	50	....	......	19
" " "	1st Pf.Cum.	3,755,700	50	7	....	38
Electric Railway Securities.						
BROOKLYN—						
Brooklyn City R. R..............	Com.	6,000,000	10	....	Q.-J.	170
" "	1st Bds.1916	3,000,000	100	5	J. & J.	.....
Coney Island & Brooklyn R. R..	Com.	500,000	100	....	Oct. 1.	.....
" " " ..	1st Bds.1909	300,000	100	5	J. & J.	.....
" " " ..	Certf. 1894.	300,000	100	6	J. & J.	.....
BUFFALO—						
Buffalo St. Railway..............	Com.	5,370,500	100	5	....	.....
" "	Bds. 1931.	5,000,000	100	....	F. & A.	.....
BOSTON—						
West End St. Railway...........	Com.	9,085,000	50	..	J. & J.	49
" "	Prf'd.	6,400,000	50	5	J. & J.	75
" "	Bds. 1902.	3,000,000	100	....	M. & N.	.....
LOUISVILLE—						
Louisville St. Railway Co........	Com.	5,000,000	100	....	....	.....
" "	Prf'd.	1,000,000	100	5	A. & O.	.....
" "	1st Bds.1930	6,000,000	100	....	J. & J.	.....
NEWARK, N. J.—						
Newark Passenger Railway......	Com.	6,000,000	100	....	....	27⅜
" "	Bds. 1930.	6,000,000	100	5	J. & J.	84⅛
NEW YORK—						
Union Railway Co...	Com.	2,000,000	100	....	....	155
" "	Bds.	2,000,000	100	....	....	.....
PITTSBURGH—						
Duquesne Traction Co....... ...	Com.	3,000,000	50	...	....	22
" "	Bds. 1930.	1,500,000	100	5	J. & J.	100
Fed. St. & Pleas. Val. R. R.......	Com.	1,400,000	50	....	J. & J.	20
" " " " "	Bds. 1919.	1,250,000	100	5	J. & J.	100
Pittsb'gh, Aleg. & Man. R. R.....	Com.	3,000,000	50	....		42
" " "	Bds. 1931.	1,500,000	100	5	J. & J.	99½
Pittsburgh & Birming. R. R.....	Com.	3,000,000	25	....	......	17⅛
" " "	Bds. 1929.	1,500,000	100	5	M. & N.	97¾
ROCHESTER—						
Rochester Railway Company....	Com.	5,000,000	100	...	....	.....
" " "	Bds. 1930.	3,000,000	100	5	A. & O.	.....
ST. LOUIS—						
Lindell St. Railway..............	Com.	2,500,000	100	....	Q.-J.	50
" "	Bds. 1910.	1,500,000	100	5	J. & J.	96½
St. Louis & Suburban............	Com.	2,500,000	400	....	....	50
Union Depot Railway............	Com.	1,200,000	100	....	....	.....
" " "	Bds. 19 0.	1,000,000	100	6	A. & O.	100

* And interest bid.

ELECTRIC LIGHT AND POWER.

PALESTINE, TEX.—The Edison Illuminating Company may add an alternating dynamo.

TAMAQUA, PA.—The Edison Electric Illuminating Company contemplates the installation of two tubular steel boilers. F. P. Spiese is purchasing agent.

WAYNE, PA.—The Wayne Electric Light Company will add a 1,000-light alternating dynamo and a 350-horse power engine. James H. Atkinson is purchasing agent.

WEST SUPERIOR, WIS.—The Superior Water, Light & Power

Company will erect a new power plant and add largely to its capacity.

York, Pa.—The People's Electric Light Company will add a 50-light arc machine for additional street lighting service. W. J. Ready is purchasing agent.

Williamsport, Pa.—The Edison Electric Illuminating Company will increase its capacity in order to supply additional power for street railway service. G. Hess is purchasing agent.

Ridgeway, Pa.—The Ridgeway Electric Light Company contemplates adding an arc system soon. H. S. Willard is purchasing agent.

Beloit, Wis.—The Wiley-Warner Electric Company will add a new engine, also storage batteries, if found practicable.

Minersville, Pa.—The Minersville Electric Light Company will increase the number of its street lamps. W. A. Kistler is purchasing agent.

Colfax, Wash.—The Colfax Electric Light & Power Company will add a new engine. J. H. Bellinger is purchasing agent.

Petersburg, Va.—The Upper Appomattox Company, Electric Light Department, will increase its water power capacity. Hill Williams is purchasing agent.

Rockdale, Tex.—The Rockdale Improvement Company contemplate an extension of its lines, in the near future. R. H. Ames is purchasing agent.

Sharpesville, Pa.—The Sharpesville Electric Light Company contemplates adding an incandescent system soon. Scott Pierce is purchasing agent.

Taylor, Tex.—The Taylor Electric Light, Gas & Power Company will add a power circuit in the spring of '94. T. E. Manson is purchasing agent.

Bristol, Pa.—The Bristol Electric Light & Power Company has recently purchased an engine and incandescent dynamo. C. E. Scott is purchasing agent.

Bellwood, Pa.—The Bellwood Electric Light Company will add a new engine and increase its arc and incandescent capacity. E. B. Kay is purchasing agent.

Du Bois, Pa.—The Du Bois Electric Light, Power & Heat Comoany, which has just completed its plant, may extend its lines soon. C. E. Bostwick is manager.

NEW BOOKS.

Note Book of Wiring Tables, compiled from the note books of practical men by Thos. G. Grier, Chicago, 1893, 64 pages, 36 tables; price, $1.00.

This volume, which is of a most convenient form for the pocket, contains in a condensed form the most useful data and tables for wiremen and persons connected with electrical work. Concise definitions are given of the terms upon which wiring tables are based, making the book of great value to the beginner.

"The Electrical Transmission of Intelligence and other Advanced Primers of Electricity." Edwin J. Houston, A. M., New York. W. J. Johnston Company (Lit'd), 41 Park Row, 1893. London: Whittaker & Co., Paternoster Square. 330 pages, 88 illustrations. Price, $1.00.

This volume is the third and last volume of Prof. Houston's Advanced Primers of Electricity. It is devoted to telegraphy, the instruments, apparatus and systems used, the telephone and telephony, electro-metallurgy, storage or secondary batteries, electricity in warfare, electric welding and electro-therapeutics. The articles of the author are able, supplemented by extracts from standard authers placed at the end of the article. Each volume is complete in itself, and are all written and arranged in such a manner as to make them valuable to the student in his early studies and to others interested in electricity in any of its many applications.

The Law of Incorporated Companies Operating under Municipal Franchises. Allen Ripley Foote, author, Chas. E. Everett, Editing Attorney, Cincinnati, Robert Clark & Company, 1893; 3 volumes 3,000 pages, post paid, $15.00 net.

This work at once supplies to a large class of people a much needed book of reference. The rapid growth in later years of incorporated bodies and the large amount of just and unjust legislation that has attended it have caused a great confusion from which Mr. Foote has picked out and ably arranged the active laws of incorporated companies. The reputation of the author and his large body of associates selected from all parts of the Union is a sufficient guarantee of the correctness and thoroughness of the work. Over 4,000 cases are cited, the table of the same covering sixty-three double column pages. The underlying principles of the law upon which the legislation of the state are based and upon which the rulings of the courts relative to these industries rest, are first considered. All the provisions of law affecting these industries are specifically and exhaustively considered, each state section being prepared by a resident practitioner. A complete list of reports of the courts of each state and their method of citation both by states and alphabetically, also specimen ordinances enacted by some of the more important cities and operated under by the franchise companies, etc. forms an appendix to the work. The index to the entire work has been arranged with special reference to a ready comparison of the provisions of law of each state upon any given question. The work will be appreciated by not only the officers of incorporated companies ane attorneys, but by officers of municipal and state governments and legislatures. The parts devoted to franchise companies and franchises will be of especial value to electric light and street railway companies.

NEW PUBLICATIONS.

A very neat catalogue of the Otis electric pumps has been received from Otis Brothers & Co., of 38 Park Row, New York. The illustrations and descriptions of the pumps and motors are very clear and comprehensive. It is of convenient size and shape for carrying in the pocket. The handsome cover gives it a very attractive appearance.

Among the recent trade publications received is one from the Carpenter Enamel Rheostat company of Bridgeport, Conn. The catalogue contains about 40 pages descriptive and illustrative of the carpenter rheostats and starting boxes, showing their construction. Field rheostats, theater dimmers, etc., are also shown with tables of sizes.

In a neat little pamphlet of 50 pages Mr. W. R. Brixey has sent out price lists of Day's Kerite insulated wires and cables. The lists contain many kinds of wires and cables, from the small single telephone or signal wire to the large telephone and messenger cables containing hundreds of insulated wires. Also plain, lead-covered and armored cable for underground and submarine work.

The new catalogue of railway apparatus just issued by the Westinghouse Electric Manufacturing Co., is one of the handsomest of the season. The engravings of motors, generators and the individual parts are remarkably clear and distinct. The reading matter, through which the engravings are distributed, contains sketches of the single reduction motors, multipolar generators and the various apparatus employed in the car equipment, and directions and information regarding the installation of the apparatus and the equipment of a car. The heavy white paper, the large type with the wide margin of the pages, together with the excellence of the press work, have produced a very fine catalogue.

PERSONAL.

Mr. M. B. Austin, of the Knapp Electrical Works, started July 29 on a two weeks vacation.

Mr. Alexander Dow has been appointed city electrical engineer of Detroit, Mich.

Wm. Hazelton, third, has resigned his position as assistant general manager of the Short Electric Railway Company.

Mr. B. M. Barr, the Cleveland, O., representative of the Eddy Electric Manufacturing Company, who has been in Chicago for several days, favored Electrical Industries with a call.

Mr. W. H. McKinlock of Chicago, accompanied by his brother, Mr. W. C. McKinlock, both of whom are well known and popular in the electrical trade, left July 26th, on The Paris for an extended trip in Europe. Electrical Industries wishes them a pleasant trip and safe return.

BUSINESS NOTES.

Mr. W. L. Abbott, 119 La Salle street, Chicago, has been retained by the council of Rochelle, Ill., as consulting engineer for the municipal plant to be installed.

The Electrical Specialty Company, Denver, has purchased the entire plant of the Columbian Electrical works of that city and will increase its capital stock to $150,000.

The Chicago Electric Motor Co. are sending out a large number of fan motors to the trade, which are giving general satisfaction. The city trade has increased greatly this season.

L. K. Comstock, 1419 Monadnock Block, Chicago, has just completed several large wiring contracts, among which are the Columbus Memorial building, the New Era building and the Polk St. depot.

Queen & Company (Inc) has in its exhibit of high grade instruments much that attracts attention. Some $3,000 worth of the instruments in the exhibit have been reserved for the Armour Institute, Chicago.

The Jenney Electric Motor Co., through Mr. A H. Goode, manager of the Chicago office of the company, report a most excellent business for the past month, especially in the smaller sizes of machines.

The Jenney Electric Motor Company, Indianapolis, Ind., has had a very busy season at its western office, Chicago. A number of large orders and a steady stream of small ones has kept this office busy.

The Citizens Street Railway Company of Kalamazoo, Mich., is using alumimum tickets. They are light and bright, about the size of a quarter, and sell six for twenty-five cents. The half fare tickets are octagonal and sell ten for twenty-five cents.

The Electric Appliance Company, 242 Madison St., Chicago, reports a continued large demand for the swinging ball lightning arrester. It is a frequent sight to see a line of poles with cone shaped boxes on every fifth or tenth pole, as 10 or 12 of the swinging ball lightning arresters are used on a circuit.

It is rumored that the Phœnix Glass Co. intend to establish a factory near Chicago for the manufacture of a full line of their goods for the western trade, and that the well-known present western representative of the company, Mr. E. N. Fox, will have charge of the factory and business.

The Chicago Electric Wire Company has secured from the government a contract for the wire for the submarine cables to be attached to the automobile torpedoes which are being tested at Willetts Point, N. Y. The contract calls for the expenditure of $75,000. This contract will take from one to two months to complete, and will require the uninterrupted work of the factory.

Campbell & Zell Company, 25 S. Gay street, Baltimore, Md., the manufacturers of the Zell improved boilers have issued a very neat souvenir of the Exposition. It is a view book of the World's Fair on the back cover of which is an illustration of 2850-horse power of Zell boilers erected by the company in the main power house at Machinery Hall. Thousands of the souvenirs are being distributed.

The Ansonia Electric Company, Michigan Ave, and Randolph streets, Chicago, finds the warm weather has so stimulated the sale of fans that it has been almost unable to supply the demand. It makes a specialty of fans operated by primary batteries and this summer there has been a large demand for them. The Edison motor, operated by the Edison Lelande batteries has been found very popular and a large stock is carried.

The Electrical Engineering Company, St. Louis, Mo., through its manager, Mr. E. G. Bruckman, has been awarded the contract for the installation of the electric light work of the new Union Depot at St. Louis. This depot is one of the largest of its kind and the electrical work is of correspondingly large size. The contract for some 6,000 lights required in the Union Trust Company's new building has also been awarded to the same company.

The Brightman Stoker Company, Cleveland, Ohio, report among recent sales the following: American Straw Board Company, Circleville, Ohio, 16 machines; Pittsburgh Water Works, 10 machines; Rocket River Paper Company, Pottsdam, N. Y., 2 machines; Brown & Co. (Inc.), Pittsburgh, Pa., 8 machines; Bailey-Farrell Manufacturing Company, 2, and W. H. Birge & Sons, Buffalo, N. Y., 2 machines. The works of this company have been very busy this season and the outlook is very bright for the later summer and fall.

The Ansonia Electric Company, corner Michigan Ave. and Randolph St., Chicago, report large sales of W. W. lightning-arresters, several orders being from foreign countries, New Zealand, India and England being on the list. The promises of orders not yet specified from central stations aggregating nearly $25,000 have recently been received. In fan motors the trade has been very good, and the Wirt dynamo brush has had a large sale. The street railway department also reports the opening of the fall trade with a number of good sized orders.

The Electrical Engineering Company, of 249 Second avenue, South, Minneapolis, Minn., reports steady increase of business since their removal to the new quarters. Among recent orders is the electrical equipment of the department store of S. E. Olson & Company, which will be the largest isolated plant in the northwest, consisting of standard arc dynamo of 180 lights and incandescent dynamo of 800 incandescent lights. Also a contract for wiring a store and office building with 430 lights using Paranite rubber-covered wire.

Mr. Peter Barclay, of Peter Barclay & Co., 54 Devonshire St., Boston, Mass., performed a rather surprising feat at the Exposition the other day. In the presence of a number of interested parties he stopped a pump, detached the lubricating oil cup and replaced it with one of his own, and had pump and cup working in 25 seconds. The cup worked at the rate of one drop in 1¾ seconds up to 32 drops a minute. These cups are extensively used. The new Cunard steamers, Campania and Lucania, were recently fitted with Barclay's cylinder lubricators.

Mr. T. C. Rafferty, the popular assistant general manager of the Great Western Manufacturing Company, Chicago, has resigned his position, severing all connection with that company August 1. Mr. Rafferty has been connected with the Great Western Company for the past two and a half years, and in that time has met with great success in furthering its interests. He is to enter into business for himself in the electrical field under the firm name of T. C. Rafferty & Co., and his wide experience, energy and acquaintance will insure the success of his new enterprise.

The Belknap Motor Company, Portland, Me., have received among other orders one from the Kansas State Agricultural College for one 40-horse power generator, one 12-horse power motor, one 10-horse power motor and one 5-horse power motor. Mr. O. P. Hood, professor of electrical engineering, and Mr. E. R. Nichols, professor of physics, composed the committee making the examination of different makes of machines, and that they decided to place the order with Manager Brown of the Belknap Company, speaks well for the quality of the B. C. motors.

The California Engineering Company, of Chicago, are now building a 1,500-horse power station for the State Street Horse R. R. Co., New Haven, Conn., of which Thos. A. Krutz, New York, is the principal owner, David Corey, of New Haven, is president, and G. A. W. Dodge general manager. This station is to have a great many innovations in the way of machinery. Compound condensing engines, surface condensers, Scotch compound tubular boilers and the compound wind system of rope transmission will be used; also wooden fly wheels are in process of construction. These wheels are 19 feet diameter specified to run 110 revolutions per minute.

The Knapp Electrical Works, 56 Franklin St., Chicago, report a large and increasing sale of the Climax iron-clad rheostat, starting boxes, stage dimmers and other similar goods, which are among its leading specialties. The Empire theater has just been equipped with them. A good demand is also reported for the improved Kester arc lamp, one of the latest of the company's specialties. The Columbia incandescent lamp is also now one of the leading specialties, and they are energetically pushing the sales in their territory, guaranteeing protection to users from all infringements. The company is happy in the thought that they have furnished 5,000,000 feet of safety seamless rubber-covered conductors for use at the World's Fair.

The Jury of Awards, Department of Electricity.

A committee consisting of Messrs. Pope, Thomas and Ulbricht appointed to formulate rules for the guidance of judges, arranged the following schedule:

I. Title of exhibit.

II. Description (including diagrams or cuts when desirable).

III. Specific claims of exhibitor.

IV. Report (stating character, details and results of examination or test).

V. Finding of Judge.

1. As to originality (defined by determining whether an exhibit has been in commercial use).

2. Merit.

a, Utility; *b*, Simplicity; *c*, Ingenuity; *d*, Reliability; *e*, Economic features; *f*, Workmanship; *g*, Finish; *h*, Design.

3. Claims sustained by examination.

VI. Recommendation as to award.

The committee suggests that there are undoubtedly many collective exhibits possessing no distinctive individual features entitled to an award; in other cases certain instruments or systems embraced in a collection may be of such special merit as to entitle them to distinct awards.

In such cases it is recommended that special awards be made for such parts of a collection as the judge may consider deserving of such honor.

ELECTRICAL INDUSTRIES.

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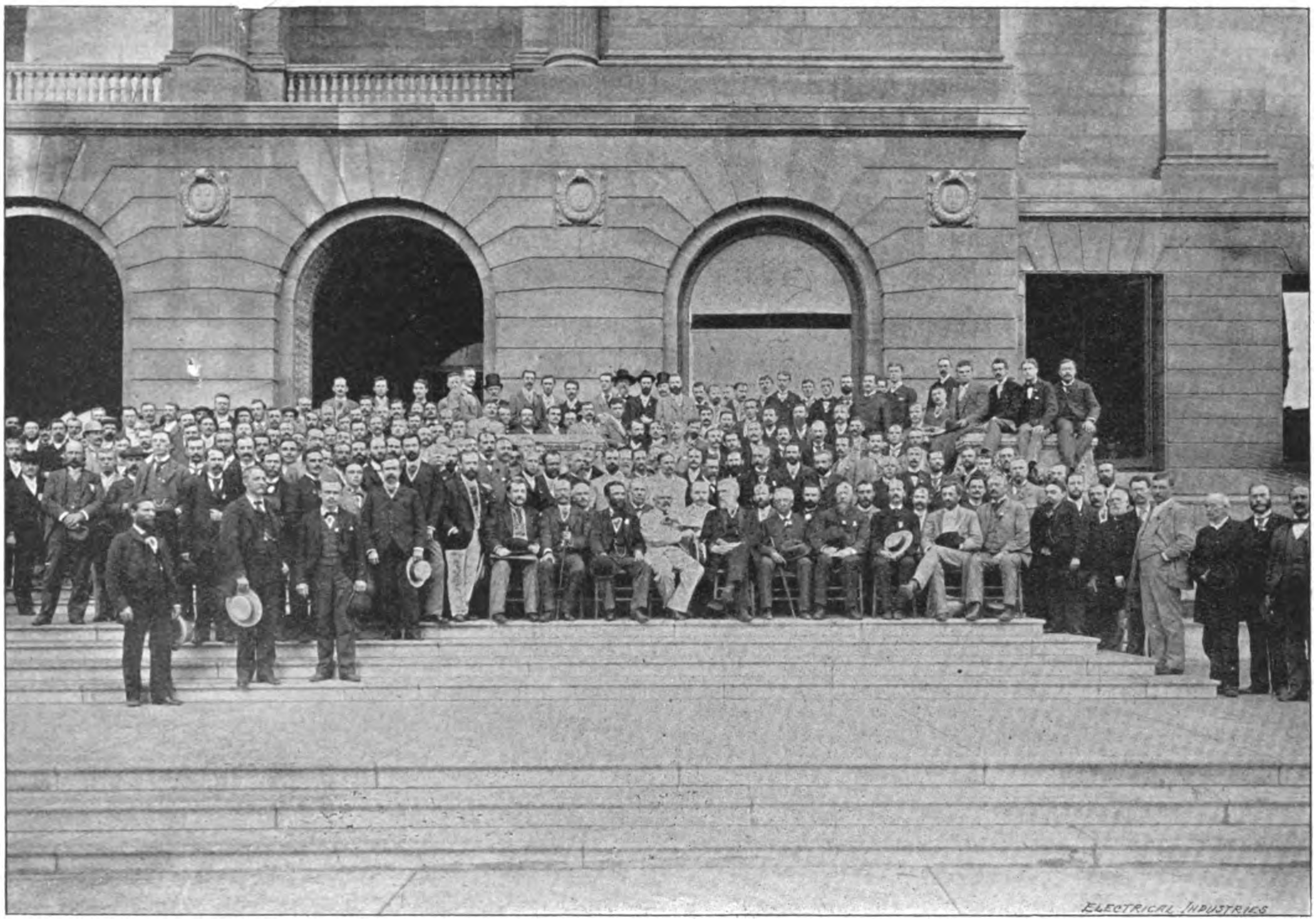
WORLD'S CONGRESS OF ELECTRICIANS.

At the adjournment of the congress on Friday, ELECTRICAL INDUSTRIES secured a photograph of the delegates assembled on the steps of the Art Institute where the sessions of the congress were held. The' accompanying engraving was taken from this photograph. Our readers will undoubtedly appreciate the picture, especially those who did not attend the congress and who are not familiar with the appearance of the many eminent scientists present.

Seated in the foreground is the chamber of delegates, with Prof Gray in the center. To the right of Prof. Gray is Dr Von Helmholz, next to whom are Mr. W. H. Preece, Prof. Rowland, Prof. W. E. Ayrton, and Alex. Siemens. In the next row, back between Profs. Rowland and Ayrton, is Dr. Silvanus Thompson, to whose left is Prof. Elihu Thomson. To the left of Prof. Gray are Prof. E. Mascart, Prof. Galileo Farraris, Dr. Violle and Prof. E. Hospitalier.



WORLD'S CONGRESS OF ELECTRICIANS.

The electricians had been gathering in Chicago for some time in anticipation of the congress and the attendance at the opening, both in numbers and the prominence was fully up to expectations. When the congress opened there were on the platform the following gentlemen, whose names are familiar to all, delegates from their respective countries to the congress: Dr. H. Von Helmholtz, Dr. E. Voit, Germany; Prof. E. Hospitalier, Prof. E. Mascart, France; Dr. A. Palaz, M. Thury, Switzerland; Prof. Elihu Thomson, Dr. T.C. Mendenhall, Prof. H. A. Rowland, Prof. H. S. Carhart, United States; Prof. Silvanus Thompson, Alexander Siemens, Prof. W. E. Ayrton, W. H. Preece, England; Dr. Johann Sahulka, Austria; Prof. Galileo Ferraris, Italy.

OPENING SESSION.

The Chicago World's Congress of Electricians was called to order in Columbus Hall of the Art Institute by Prof. Elisha Gray, at 3:15 o'clock P.M. on Monday, Aug. 21st. Prof. Gray read an address welcoming the delegates and the members of the congress, and at the end called for nominations for temporary chairman. Mr. W. H. Preece, a delegate from Great Britain, in a very neat little speech, proposed for temporary chairman Elihu Thomson, of Lynn, Mass, who was elected by acclamation. Prof. Thomson, on taking the chair, made a short speech which was received with applause.

On calling for nominations for temporary secretary, Prof. E. R. Cross, of the Massachusetts Institute of Technology, Boston, proposed Prof. F. B. Crocker, of Columbia College, New York, who was elected by acclamation. The chair then appointed as a committee for the nomination of permanent officers Prof. T. C. Mendenhall, Prof. B. F. Thomas, Dr. Louis Duncan, Prof. Silvanus P. Thompson, Prof. E. Hospitalier, Dr. A. Lindeck, and Dr. A. Palaz, who then retired. Prof. Thomson called on Prof. W. E. Ayrton to say a few words on the subject of the World's Fair as seen by a foreigner.

Prof. Ayrton stepped forward, prefacing his speech by saying that the chairman had made a mistake in calling him a foreigner, as no Englishman could be a foreigner in America. He preferred to be called a stranger. He then went on to say that Chicago is a long way from the seas, and he thought that a stranger's impression on electrical matters began long before he arrived at the white city. After describing what impressions a stranger would receive in his journey to Chicago in the various eastern cities he might visit, he said: He is as much astonished with the courtesy with which he is shown every detail in the factories as by the magnitude of the undertakings. His expectations are aroused to such a pitch, that he expects that when he comes here to Chicago, to find a display which will cast all previous electrical exhibitions into the shade. Well, take this stranger into the Electricity Building blindfolded, so that his judgment will not be warped by the glories of the outside surroundings, and leave him there, and after a while, if he be candid and if he can master up courage to say a word which might cause pain to those whose kindness has made them dear to him, he will say he is a little disappointed that the world has not better answered the invitation to show the Electricity Building what it could do.

The stranger feels that the real electrical display of America is not in the Electricity Building but in every street where there are trolley wires, in every town and village where there are electric lights—and where is the town in this country where there are not? But if the stranger be thoughtful, he is not disappointed. In Frankfort it was what was inside the Electricity Building that dazzled the mind; at Jackson Park it is what is outside of the Electricity Building that rivets his attention. The committee now returned, and Dr. Mendenhall, as chairman, reported the nominations as follows: For honorary president of the congress his excellency Dr. H. Von Helmholtz, of Germany; as permanent chairman of the congress, Prof. Elisha Gray, of Chicago; as vice-presidents, representing the United States, Edw. Weston; Great Britain, W. H. Preece; France, E. Mascart; Germany, Dr. Voit; Austria, J. Sahulka; Italy, Prof. Galileo Ferraris; Switzerland, Dr. H. F. Weber, who were elected by acclamation. Prof. F. B. Crocker was then nominated as permanent secretary and was elected by acclamation.

In presenting Dr. Von Helmholtz as the honorary president of the congress, the chairman, Prof. Thomson, called attention to his very great achievements and to the fact that at the beginning of his career but a trifle was known of the science of electricity. Dr. Von Helmholtz, on accepting the presidency, was received by the audience standing and with the heartiest applause. He spoke shortly of the honor that he considered was conferred on him by the position, and said in his remarks: "The beginning of my career was when the phenomena of electricity were most delicate experiments which were performed by some physicists in their laboratories. We can move at present great machines of the greatest power. At the time I began the study of electricity, we could not move a little magnetic needle suspended on a silken cord, the finest that we could find. We could not move the slightest apparatus, but we showed that there were feeble currents. We were obliged to work with the simple elements zinc and copper, without sulphate of copper, elements which altered every moment; which at the first instance had a great electromotive force, then went down and down, so that after some instances there was only a trace of the former force."

In conclusion, he said: "The history of the world and the history of science has grown rapidly during our life time, and it is a great pleasure for us old men, to see now what electricity has reached in its new stages and to admire the newest developments that are collected on this festival occasion here in your great exhibition." Prof. Gray was then introduced by the chair as the permanent chairman of the congress and made a short speech of acceptance, and then introduced in turn Mr. W. H. Preece as vice-president representing Great Britain, whose speech of acceptance was brief but heartily applauded. The chairman then introduced Prof. Mascart, who made a short speech. Dr. Mendenhall, on behalf of the program committee, made a few remarks as to the conditions for membership of the congress, etc. The delegates to be distinguished by a white badge, and all persons who have received invitations and those whose name appears on the printed list of reference will receive a red badge; to others they will be issued on the presentation of a card endorsed by the committee. Mr. R. W. Pope, W. E. Anderson, and Dr. J. Allen Hornsby were appointed a committee on entertainment and will, from time to time, report such arrangements as were made.

TUESDAY'S SESSION.

The different sections of the congress assembled in the halls assigned. Section A of pure theory was called to order at 10:30 by its chairman, Prof. H. A. Rowland. The chair appointed a committee to nominate the permanent officers of the section. The following names were recommended by the committee and elected by acclamation: Prof. H. A. Rowland, chairman; Prof. Galileo Ferraris, vice-chairman, and Dr. A. S. Kimball, secretary. After disposing of other details of organization the section adjourned till 10 A. M. Wednesday morning.

Section B was called to order by Prof. Chas. R. Cross, of the Institute of Technology, Boston, at 10:15 A. M. The first business in order was the appointing of a committee to nominate permanent officers for the section, a chairman and a secretary, and at the suggestion of the temporary chairman a third officer was added to the list, which was composed of Prof. Silvanus P. Thompson, London; Prof. Louis Duncan, Baltimore, Md., and Lieut. W. F. C. Hassan, San Francisco. The committee retired and returned in a few minutes recommending that Prof. Cross be continued in the chair, Lieut. Samuel Reber appointed permanent secretary with Prof. Dolbear as the third officer of the section. Prof. Elisha Gray announced that section A would meet in Hall VI., section B in Hall VII. and section C in Hall VIII.

The reading of the regular papers on the program was then taken up and Mr. W. H. Preece, F.R.S., read the first paper on "Signaling through Space by Means of Electro-Magnetic Vibrations." Starting from the discovery by Henry in 1842 of the transmission of signals through the vibration of the magnetic needle in the cellar charged by a Leyden jar in an upper room of his house, Mr. Preece lead down to 1884 when it was first reported to him that messages in transit over the underground wires of the London telegraph system had been read over a telephone, the wire of which was 80 feet distant, and incidentally referred to Edison's experiment in 1885 in the transmission of messages from a moving train on the Lehigh Valley Railroad to the wires on the side of the track.

Mr. Preece was last year appointed a member of the Royal Commission to investigate the communication by electricity between light houses, light ships and the shore, and his address was a description in part of the experiments made by this commission on the coast of Bristol Channel. Mr. Preece did not read his paper in full but gave the convention the results of the investigation and the particularly interesting points leading up to them. The result of these experiments were due entirely to the electro-magnetic induction; the self induction and the electro-static induction playing but very slight parts in the general results. The main experiment consisted in the running of a grounded line three-quarters of a mile long on the shore of the channel and the running of a parallel line of the same length on a small island something over three miles distance from the shore, and a third line parallel to the other two and of the same length on a second island some five miles distance from the shore. With a steam launch cables were laid at various distances and experiments made as to the possible reading, on such cables through a telephonic connection, of signals sent with an ordinary Morse instrument over the land wire. It was found that when the cable laid on the surface of the water (as it did when being rapidly played out from the steam launch, one end of it being attached to a buoy, the signals could be very distinctly heard. While, when the cable had sunk under the water to a depth of 6 inches or more the induction ceased. This lead Mr. Preece to make certain experiments which established beyond doubt the fact that electro-magnetic waves are reflected from the surface of the water and do not perculate. With 15 amperes of current and a frequency of 192, experiments were made between the land and the three miles island wire, with the result that the signals were read by telephone and the notes were very clear. In experiments with the wire on the five mile island, and with the same frequency and current on the shore wire, the signals were heard but the current was not strong enough to make the Morse code readable. Mr. Preece is of the opinion that had he had five amperes more of current at hand the signals would have been as clear on the five mile island at 20 amperes as they were on the three mile island at 15 amperes. In all of these experiments the readings were made by from three to five different persons to preclude any possibility of the supposed effect being the result of imagination. With wires 30 miles long on each side of the British Channel Mr. Preece is confident that communication by electro-magnetic induction could easily take place between England and France, though he doubts very much if this method will ever come into commercial use for various reasons; principally owing to its being more expensive than the present cable system. The English light houses and light ships, as a result of these experiments, will be connected to the main line by regular cables, though it is highly possible that induction may be used by the light houses and light ships for the transmission of signals to vessels during time of fog. The engineer of the coast of Scotland is at present engaged in the introduction of a system for the protection of vessels approaching the coast by the laying of a cable at the 20 fathom line along the coast and using electro-magnetic induction for the transmission of signals between the shore and the ships through this cable. No practical results have yet been attained in this direction.

In the discussion that followed the reading of Mr. Preece's paper, Mr. T. D. Lockwood, electrician for the American Bell Telephone Company, Boston, delivered a somewhat lengthy expression of opinion and gave a resume of some similar but far less important or interesting experiments that had been made in this country. He also expressed his doubts in regard to the transmission being due entirely to the electro-magnetic induction but inclined to the opinion that water played a very important part. In his final remarks at the close of the discussion, Mr. Preece, in a very few words, showed Mr. Lockwood that he was in error. Owing to the length of Mr. Lockwood's comment Prof. Carhart of Ann Arbor, felt called upon to move that the discussion by any one member of a paper that had been presented be limited to five minutes. The chairman declined to put the motion but suggested that the members so understand it. Dr. Carroll expressed his appreciation of Mr. Preece's paper and recited an incident that came to his attention some 15 years ago where messages had been transmitted over telephonic circuit, the wire of which had been broken and the two ends resting some ten feet apart on a large block of stone. The incident at the time was considered so improbable that the Doctor had never mentioned it until Mr. Preece's paper had proven to him the entire possibility of the occurrence being true. Prof. Jamieson desired to inquire what was the greatest distance from the cable in the north of Scotland at which signals could be received by an approaching ship. Mr. Preece replied that the distance would be regulated by the length of the ship, or the length of the cable on the ship.

Mr. Heaviside, the associate of Mr. Preece who had charge of the experiments described in the latter's paper, was introduced by Mr. Preece and made a short address in which he described an experiment he recently conducted in the pit of a colliery, where he ran a line on two sides of a triangle and made the connection for the third side by means of a ground, it not being possible to run the third side owing to the location. He then constructed a similar triangle on the surface, having all three sides of wire. Signals were transmitted by electro-magnetic induction from the lower circuit to the upper, and received by telephone. The practical result of this experiment can be utilized for communications between imprisoned miners and the outside world, provided cables can be constructed in some way so as not to be broken by the falling rock. Dr. Emery called the attention of the congress to the different principles employed in Mr. Preece's experiments and the American experiments sited by Mr. Lockwood. Messrs. Delaney, Wiegand, Wynn and Lemp asked various minor questions which were replied to by Mr. Preece. Prof. Cross also made a suggestion with reference to the loss of energy in reflection by the electro-magnetic wave.

The second and third papers on the program "Materials for Standards of Resistance and their Construction," by Dr. St. Lindeck and "Variation of P. D. of the Electric Arc Current, size of Carbons and Distance Apart," by Prof. W. E. Ayrton, F. R. S., were not read owing to the absence of the two gentlemen mentioned. The fourth paper on the program was by Dr. Silvanus P. Thompson, entitled "Ocean Telephony." Prof. Thompson finished his paper at 12:45 and the congress adjourned till the following morning.

SECTION C. was called to order at 10:20 A. M., by the temporary chairman Prof. E. J. Houston. The committee on nominations present the following lists of names: Permanent chairman, Prof. Edwin J. Houston; vice-chairman, George P. Low and secretary Prof. E. P. Roberts; committee for the section George Blodget, Dr. F. H. C. Perine and Townsend Wolcott. The report was accepted and short speeches were made by Prof. Houston and Messrs. Lowe, Roberts, Jackson and others. A very interesting paper was read by Mr. Franz Shulze-Berge, of Brooklyn on "Rotary Mecurial Air Pumps" which was illustrated by comprehensive diagrams. After a brief discussion the section adjourned and those present attended the session of section B.

WEDNESDAY'S SESSION.

At this session of section A., Prof. A. Macfarlane read a paper on "The Analytical Treatment of Alternating Current" which was discussed by Mr. Chas. P. Steinmetz. The paper of Drs. Bedell and Crehore, "General Discussion of the Curren Flow in Two Mutually Related Circuits Containing Capacity," was presented.

Section B was called to order at 10:10 Wednesday by Chairman Cross and after the reading of the minutes of previous meeting by Secy. Reber the discussion of Prof. Silvanus P. Thompson's paper was taken up. Dr. Carroll desired to present the congress a tube made of an alloy of aluminum, silver and copper prepared in his laboratory, and expressed the belief that such an alloy would be better fitted for telephonic purposes than the conductors now used. Prof. Jamieson made the point that whereas the present cables used cost but £40,000 per mile a cable made in accordance with Prof. Thompson's paper with three conductors would cost probably three times as much. He also desired to know how Prof. Thompson would localize faults or flaws.

Mr. Lockwood had to suggest that several pieces of underground cable of similar construction be spliced until a cable be produced with which the practicability of Prof. Thompson's ideas could be tested. Mr. Kennelly called attention to the ideal method devised several years ago by Mr. Oliver Heaviside for absolutely eliminating effects of electro-static induction. Mr. Cuttriss, electrician for the McKay-Bennett cable system, described certain experiments made under his direction with a two wire cable connected in straight cord, metallic and multiple circuit, the result of which show but slight variation in the three styles of connection. He also offered to place the cables of his company at the disposal of Prof. Thompson for the conducting of further experiments. Mr. Heaviside expressed his appreciation of Prof. Thompson's paper both from a scientific and commercial point of view and added that his experience since 1877 confirmed the principles laid down in the paper.

Mr. Wilkinson inquired whether the effect of the three wires did not tend to cause further retardation of the signals. Mr. Siemens, of Siemens Bros., London, the cable manufacturers, said that such a cable as Prof. Thompson proposed would be extremely difficult to construct and would cost much more than cables, for telegraphic purposes at least, which would give a similar speed. He called attention to the fact that capacity is not the only enemy of the telegraph but that the insulating materials play an important part. Prof. Cross made the point that while, with the telegraph and the siphon recorder, from the point of extreme legibility to illegibility there is considerable latitude, with the telephone, from audibility to inaudibility there is but a slight step. Prof. Thompson replied quite humorously to the various criticisms made on his paper and expressed himself as believing that he is still on the right side and sincerely hoped that one effect of the reading of his paper will be the giving of his plans a practical trial, which can only be done when the large cable interests cooperate in making such a trial possible.

Dr. St. Lindeck of the Reichsanstalt, Berlin, read an interesting paper on "Materials for Standards of Resistance and their Construction," in which he described the result of the experiments made by Dr. Feusner and himself at the Reichsanstalt during the past four years. He described tests made of platinum-silver, german silver, patent nickel and manganese alloy. He found that where the percentage of zinc was less in the alloy there was less variation of resistance. The variation in the first two alloys mentioned proved them to be unfit for standards; while the patent nickel alloy used by Siemens & Halske, of Berlin, and composed of 25 parts nickel and 75 parts copper stood the tests remarkably well; an alloy called maganin and composed of 84 parts copper, 12 parts manganese and four parts nickel stood the test for a space of two years with a variation of but a few thousandths of one per cent.

Mr. Edw. Weston of Newark, N. J., discussed Dr. Lindeck's paper at considerable length, the rule as to the time being suspended in this instance. He said that such papers as Dr. Lindeck's tend to increase the confidence of the electrical fraternity in these alloys as standards. In 1884, Mr. Weston began a series of researches of alloys for resistance purposes at his laboratory at Newark, N. J., examining in the neighborhood of 400 of them About 150 of this number he was able to work satisfactorily and to get from them good and thin wires, and out of this 150 the alloy which suited his purposes best was that described by Dr. Lindeck as manganin. He also expressed the hope that this congress will pass upon these alloys and decide on a unit as a substitute for mercury. Prof. Thompson objected to magnanin on the ground that it is rendered entirely useless as a standard when heated above a certain temperature. Dr. Lindeck replied that the use of any standard necessarily involved care; and doubted whether any standard could be established that could not be subject to a sufficient strain to destroy its usefulness.

Mr. A. E. Kennally read a paper on "Some Measurements of the Temperature Variation in the Electrical Resistance of a Sample of Copper" which he stated was the joint production of Prof. Reginald Fessenden of University of Pennsylvania and himself. The paper described the experiments of Matteson and Dr. Siemens and the varying results obtained by them, together with the experiments of later investigators and scientists to establish the temperature co-efficient of copper. He then described the experiments made by the two authors of the paper at Mr. Edison's laboratory at Newark, N. J., and gave the mathematical result of such researches which coincided very nearly with the results obtained by those investigators following in the footsteps of Matteson and Siemens. Mr. Preece thanked Mr. Kennelly for his investigations and insured him on behalf of the English electricians that the co-efficient established by himself and Prof. Fessenden will be accepted in England without hesitation.

The next paper was a "Note on Photometric Measurement" by Prof. B. F. Thomas. As a result of his investigation Prof. Thomas showed quite conclusively the impossibility of making accurate photometric measurements without taking into consideration the reflection from the rear surface of the chimney used on a standard light. He said that he believes this reflection is sufficient to account for the difference in measurements made by various laboratories of the same light. He suggested that square metallic chimneys with black background and the mica front be used so as to avoid the reflective and lenticular effects. Referring to the tests of the candle power of incandescent lamps Prof. Thompson remarked that the only way to arrive at a correct measurement of the candle power would be to have the lamp revolve at the rate of say 1,000 revolutions per minute, and this can be done only with short or anchored filament lamps. Owing to the lateness of the hour discussion of Prof. Thomas' paper was postponed until 10 A.M., Thursday.

This session of section C. was opened by the reading of the paper of Prof. Jackson on "Underground Electrical Construction in the United States." The various systems were described in detail and the discussion which followed was entered into by a number of those present. Mr. A. W. Heaviside described in a general way the conduit work as constructed in England for electric lighting. Prof. Jackson answered the large number of questions in a most satisfactory manner. At the conclusion of the discussion Dr. J. Sahulka read a paper, "The Various Uses of the Electrostatic Voltmeter. Dr. Sahulka was followed by Mr. L. B. Marks with a paper on "A Hundred Hour Electric Arc Lamp." The paper was discussed by Prof. E. L. Nichols and Prof. S. P. Thompson who in his discussion described some of his experiments with the arc lamp. Also by Mr. Geo. P. Lowe, Prof. E. P. Roberts and Dr. N. S. Keith.

THURSDAY'S SESSION.

On Thursday, section A was called to order at 10:15 A.M., with Prof. Eddy in the chair. Dr. Bedell furnished the reading of his paper on mutual induction and capacity. Dr. John Sahulka then read a paper "On the Explanation of the Ferranti Phenomina," after which the section adjourned until Friday.

Section B was called to order by Prof. Cross, and the section proceeded with the discussion of Prof. Thomas' paper. The question was discussed by Carl Hering and others. At 10:45 Prof. Henry S. Carhart read a paper on "A Pair of Electrostatic Voltmeters," describing an instrument which he had had in use for some time past. The needles and mirror being suspended by fibre from the top and steadied by a small spiral spring from the bottom. He said that the instrument was very accurate and excellent for laboratory use.

At 11:10 Prof. Webster read a paper on "A Method of Governing an Electric Motor for Chronographic Purposes." The purpose of the governing was to control the revolutions of the chronograph absolutely so that the error in time would be very slight. The means of doing this was through an electro-magnetic arrangement of a tuning fork. The secretary, Lieut. Reber, then read Prof. J. A. Ewing's paper in "Iron for Transformers from the Magnetic Point of View." At 11:30 the section was adjourned until 12 o'clock. On reassembling after adjournment a paper was read by Prof. Andrew Jamieson on "London Electrical Engineering Laboratories." The author said that the title of the paper was somewhat incorrect, and that he had no idea of being called on for such a paper when he arrived. From the way with which the subject was handled it was evident that he is thoroughly familiar with the subject. In his remarks he said: It has often been brought to my notice that the question of a boy's education cannot always be decided by rules and that it must be decided largely from the bent of the boy himself. The Professor said that if the boy evinced a tendency to flightiness of disposition or showed a disposition to slight things and to play with batteries and other small tools, his education certainly should begin with an apprenticeship to some good shop where he would learn the value of work, and would be kept down to it until his flightiness ceased. He should then be sent to some good technical school to complete his education. On the other hand if the lad was studious, steady in his habits and had a good head for mathematics it would be much better for him to be sent immediately to college and get his practical apprenticeship afterwards. He said that in many cases in the city of London schools, the night student who had to work hard all day and studied evenings outstripped his more fortunate competitor who was enabled to attend the colleges during the day. He described the laboratories of the various technical schools, starting first with the city and guilds of London Institute of which Prof. W. E. Ayrton is the head, and which Prof. Jamieson thought was the best type. Others which he described in detail were the Siemens laboratory under the charge of Dr. John Hopkinson, the laboratory conducted by Mr. Kennedy, and entered into quite a detailed description of the Finsbury College conducted by Sylvanus P. Thompson. Others were also described. There was more or less discussion by Dr. Boehm, Prof. Reed of Ann Arbor and Prof. Cross of Boston. Dr Bedell read his paper on "Transformer Diagrams Experimentally Determined."

Section C was called to order at 10:10 A.M. After disposing of the routine business of the section, Prof. F. B. Crocker presented his paper "On Direct Current Dynamos of Very High Potential," in which he described various experimental machines made under his direction having very high potential. Dr. Keith, at the close of the paper, called attention to the fact that dynamos of high potential had been in use in San Francisco since 1887, and that at the present time there are not more than half a dozen motors in that city which are not operated by high potential current.

At the close of Dr. Keith's remarks the discussion on long distance power transmission was opened with a very able paper by Dr. Louis Duncan of Baltimore. Dr. Duncan was followed by Mr. Scott of the Westinghouse company who described, with the assistance of large diagrams, the Tesla polyphase system as exhibited at the Fair. Lieut. Hasson of San Francisco spoke very humorously and laid stress upon the point that while there are many beautiful theories there has not as yet been a practical application of long distance electrical power transmission within his knowledge which has stood the test of actual use.

Dr. Bell of the General Electric Company spoke decidedly in favor of alternating currents for power transmission because they can be twisted around to better advantage than the direct current, and the single phase motor in its present state of development can be considered nothing more than a poor polyphase motor. There are two systems of polyphase according to Dr. Bell, the independent and the dependent circuit system. Personally Dr. Bell is an advocate of the dependent circuit of the polyphase system for such transmissions of power. Mr. Stillwell of the Westinghouse company made a few remarks, in the course of which he said he hoped that after the large companies had gone to so much labor and expense to perfect a new system for power transmissions, that the consulting engineers would not force them to install the plants at their own expense and guarantee the dividends before they (the engineers) would be convinced of the practicability of the system.

Mr. Frick, of Germany, described the various power transmission plants in his country which have been working from one to two years, giving entire satisfaction, and said he believed do one system the best for all purposes; each has its good points. Prof. Thompson read from notes made by Mr. Thury, of Switzerland, a description of power transmission plants located at various points on thecontinent, and afterwards made some very interesting remarks, and give it as his personal opinion that the polyphase system is preferable only where no general distribution of power is to take place at the receiving end of the line, but that where distribution is to take place the alternating system is preferable. Prof. Forbes, of London, arrived while Prof. Thomson was speaking, and at the conclusion of the professor's remarks, expressed his belief that while the three phase system is attractive from its beauty the two phase system is much better adapted to practical uses.

Mr. Steinmetz closed the discussion by calling attention to the fact that the continuous current is still more largely used than any other, and expressed the opinion that the single phase system will be the system of the future, that such objectons as are now raised to it will be soon overcome, and that we are nearer the ideal condition than is generally supposed.

The next paper on the program was that of Dr. C. Pollak on "The Conversion of Alternating into Continuous Currents," which was appreciatedly received but not discussed owing to the hour for adjournment having considerably passed. The machine described in Dr. Pollak's paper can be seen in operation in the German section of the Electricity Building at the Fair.

FRIDAY'S SESSION.

Section A. was called to order at 10:10 a. m. and the Secretary read by title two papers, one by Prof. A. Blondel on " Measuring the Power of Polyphase Currents," the other, by Prof. W. E. Ayrton, F. R. S. on " Extended Use of the Name Resistance in Alternating Current Problems." The session then adjourned to the afternoon session when the report of the chamber of delegates is to be presented.

Section B. After the reading of the minutes of the previous meeting the section listened to a paper read by Prof. W. E. Ayrton, F. R. S., on the "Variation of the P. D. of the Electric Arc, Current, Size of Carbons and Distance Apart. Prof. Ayrton's paper was a very able description of the experiments made under his direction during the past five years for ascertaining an absolutely reliable formula for the potential difference between the carbon points of the electric arc. These experiments have not been fully completed nor the computations made, so Prof. Ayrton was not able to give the congress the corrected formula which will be the final result of his experiments and calculations in this direction.

In the discussion which followed the reading of this paper Prof. Elihu Thomson made a brief address in which he stated that experiments conducted by him in 1884 and since that time coincided in results quite closely with those described by Prof. Ayrton. Prof. Cross, Mr. Henriques, Prof. MacFarlane and Dr. Silvanus P. Thompson participated in the discussion. The next paper was on the " Light and Heat of the Electric Arc" and was read in French by Dr. J. Voille. Dr. Silvanus P. Thompson gave an abstract of the paper in English after the reading of the same in French by the author, in which he said that a translation of a similar article by Dr. Voille could be found in the London Electrical Review for Aug. 4, 1893.

Prof. Elihu Thomson, Prof. Webster and Mr. Henriques participated in the discussion of the paper, some of the gentlemen addressing their remarks to M. Voille in his own language, to which Dr. Voille responded.

Dr. Silvanus P. Thompson presented his paper on " The Swinburne–Thompson Unit of Light" without reading, as the time for adjournment was approaching. The paper was intended to prove that a square millimeter of the surface of the crater of the positive carbon should be taken as the unit of light.

Prof. F. B. Thomas presented a short paper on " Periodic Variation of the Candle Power of Alternating Arc Lights" together with a diagram of curves showing the results of measurements made by him in recent experiments. There was no discussion of this paper. The last paper on the program was that of Prof. H. S. Carhart on " The Maximum Efficiency of Arc Lamps with Constant Number of Watts." The author had intended to simply have this paper read by title but on request gave a brief outline of it without reading it in full. The paper was a suggestion to rate arc lamps by the number of watts expended upon them instead of by the candle power as is the present custom. Prof. Carhart merely offers the proposition as a suggestion, realizing that there are objections as well as points in favor of this idea. Prof. Ayrton expressed his appreciation of Prof. Carhart's paper as it had to do directly with his own line of experiments. The following papers were presented but not read: " On the Source and Effects of Harmonics in Alternating Circuits" by Prof. H. A. Rowland, " Sour 1' Arc a Constant de Lumiere" and " Nouvelles Recherches sur l'Arc a Curants Alternatifs" by A. Bondel. This section then adjourned to meet in Columbus Hall at 3 P. M. to hear the report of the chamber of delegates.

Session C was called to order by Prof. Houston at 10:15 A.M. Dr. Pollak read a few notes on the convertion of alternating into continuous currents for charging storage batteries. Mr. Frick, of Germany, then spoke in reference to the load line of central stations as determined by tests made on days in three different portions of the year. He exhibited diagrams of these load lines and showed how accumulators could be applied for easing up the use of the machinery as well as being less costly to install. He said that accumulators were in use in all stations in Germany and in nearly all stations on the continent of Europe, and that without exception they were well liked by all who had them in use.

At 10:30 Prof. Geo. Forbes, of London, the consulting electrician for the Cataract Construction Company, of Niagara Falls, reopened the discussion on long-distance power transmission that was started yesterday. He said that as 1890 he had stated it as his opinion and had since seen no reason to change it, that the two-phase alternating current was the proper thing to use for long distance transmission, the two separate circuits being kept independent. In some shops single phase motors can be used, in others two phase, and where direct current is needed alternating motors of either style could be used to drive direct current dynamos. He called attention to the commutating machines now commonly known as rotary transformers and said that while this was perfectly feasible he thought the expense of the machine and the losses in efficiency due to its construction would prohibit its use. Some simpler form of commutating device might be made which would not consume so much energy.

He expressed as his opinion that not very far in the future we should be in possession of a simple device for this purpose, which would change alternating currents into direct currents and that without the consumption of any large percentage of energy, and instanced as such the very ingenious machine exhibited and explained by Dr. Pollak. He stated that Gramme's first alternating dynamo was two phase with a stationary armature. In reference to the question as to whether he would favor the direct production of the required high potential by the machine itself or would use step-up transformers, the dynamo being run at high pressure, he favored the first method as with the standing armature it would be perfectly feasible to obtain the requisite potential without danger to the machine.

From a financial point of view it was very much cheaper as the transformers for such work would cost nearly if not quite as much, as the dynamo itself, and three or more per cent of such loss in such transformation would amount to $3,000 per year, counting the cost per horse power at $20, which, capitalized at 5 per cent, would be $60,000, or more than the entire cost of the dynamo. In regard to the conductors to be used and the location of the same, he very much favored the use of bare wires in a large subway so constructed that the inspector could walk through it. In any overhead construction there would be more or less trouble from sleet and various other difficulties, while the use of conduits for drawing cables in and out would be impossible.

After speaking for an hour Prof. Forbes was followed by Prof. H. A. Rowland, of Johns Hopkins, who argued that the mere loss of three per cent in the efficiency of the transformer, could be easily made up by turning on a little more water, that he did not think it cut any figure at all, and that as for the direct production of the excessively high pressures in the armature itself, he very much favored the use of the step-up transformer as liable to be of less trouble for repairs and shut downs. He had considerable to say in regard to the frequency which would be best to use in this general transmission as a frequency that would be proper for motors would not be right for the incandescent lamp as at 35 or less periods per second, the effect on the eye was decidedly unpleasant, and also could not be used for synchronous motors.

CLOSING SESSION.

The afternoon session was held in Columbus Hall, the chamber of delegates taking their place on the platform at 3.10 P.M. The report of the chamber of delegates was read by Prof. E. L. Nichols, and was as follows: Gentlemen of the International Congress: The chamber of delegates has made a careful investigation in accordance with the program laid down, and has reached certain decisions which it is my duty as secretary to report. The first question which came before the chamber had to do with the adoption of definitions and values of fundamental units of resistance, current and electro-motive force. The following resolutions on this point have been passed by the chamber of delegates:

Resolved, That the several governments represented by the delegates in this international congress of electricians be and they are hereby recommended formally to adopt as legal units of electrical measure the following:

As the unit of resistance the international ohm, which is based upon the ohm equal to 10^9 units of resistance of the initial C. G. S. system of electro-magnetic units and is represented by resistance offered to an unvarying electric current of a column of mercury at the temperature of melting ice, 14.4521 grammes in mass, of a constant cross sectional area and of a length of 106.3 centimeters.

As a unit of current the international ampere, which is one-tenth of the unit of current of the C. G. S. system of electro-magnetic units, and which is represented sufficiently well for practical use by the unvarying current, which, when passed through a solution of nitrate of silver in water, in accordance with the accompanying specifications, deposits silver at the rate of 0.001118 of a gramme a second.

As a unit of electro-motive force the international volt, which is the electro-motive force that, steadily applied to a conductor whose resistance is one international ohm, will produce a current of one international ampere, and which is represented sufficiently well for practical use by 1,000-1,434 of the electro-motive force between the poles or electrodes of the voltaic cell known as Clark's cell, at a temperature of 13 degrees centigrade, and perpared in the manner described in the accompanying specifications.

As the unit of quantity the international coulomb, which is the quantity of electricity transferred by a current of one international ampere in one second.

As a unit of capacity, the international farad, which is the capacity of a conductor charged to a potential of one international volt by one international coulomb of electricity.

As the unit of work, the joule, which is 10^7 units of work in the C.G.S. system and which is represented sufficiently well for practical use by the energy expended in one second by an international ampere in an international ohm.

As the unit of power the international watt, which is the equal to 10^7 units of power in the C. G. S. system and which is represented sufficiently well for practical use by the work done at the rate of one joule per second.

Concerning the adoption of a definition and value for the unit of induction the chamber of delegates has resolved, upon the motion of Prof. Mascart of France, and seconded by other foreign members, that the unit of induction shall be called the henry, which is the induction in a circuit when the electro-motive force induced in this circuit is one international volt while the inducing current varies at the rate of one ampere per second. With regards the question of the selection of names for magnetic units and the units of light and energy, it was resolved that in these cases no specific name should be applied but that these units should be designated as C. G. S. units.

In addition to these topics two others have been considered. The question of standards of light was considered and a committee was appointed to deliberate on this very vexed question of the electrical engineer. I have the pleasure of reading the report of the committee, which report has been received and adopted by the chamber of delegates. The committee says it has had much discussion upon the various forms suggested for standards, and in particular upon the two special forms of lamp known respectively as the amylacetate lamp of Von Hefner Alteneck and the pentale lamp of Vernon-Harcourt. The committee recommends that all nations be invited to make researches in common on well-defined practical standards and on the convenient realization of the absolute unit.

Finally there was before the chamber the question of the modification of electrical notation and nomenclature, and an extended and carefully matured scheme was presented by M. Hospitalier and others. After due consideration and after some amendments and modification of this plan had been made, it was moved that the report be received and printed as an appendix to the regular proceeding and as the report of a sub-committee.

Prof. Gray then stated that he had a few announcements to make relative to to-morrow's work or to-morrow's pleasure and that Mr. Preece also had an announcement to make.

Mr. Preece spoke as follows: "Ladies and Gentlemen: My announcement is an extremely simple one. As president of the Institution of Electrical Engineers in England, it was my wish to invite the members of the Institute of Electrical Engineers in America to meet me at Victoria House in the grounds of the World's Fair, especially as they have done me the great honor of making me an honorary member, there are only two and I am one of them, of their body. I had this great difficulty that the addresses, either of the members of the American Institute or of the Congress, have not been very carefully kept, and therefore I now invite all the members of this Congress, whether members of the American Institute of Electrical Engineers or not, to allow me to have the pleasure of receiving them to-morrow afternoon between the hours of five and seven, in my present British home, Victoria House, World's Fair grounds."

Dr. Von Helmholtz then arose and addressed the congress, saying: "Ladies and Gentlemen: We have come forward here to do a really important work and one which I trust will have good fruit for future time in correcting the incongruities of electrical science and electrical notions, so that all scientific and industrial men can understand each other in the simplest and best way. It was rather a hard piece of work to do in these hot days in continual meetings of the delegates and members of the congress, and he who has had the greatest part of the exertion and work in this connection is our president, Prof. Elisha Gray. I therefore trust you will express to him your thankfulness and give him a vote of thanks." M. Mascart of France then spoke in French in substance as follows:

"My associates join with me in heartily seconding the proposition of Dr. von Helmholtz, to express our thanks to the distinguished President of the Congress of Electricians. We have admired the urbanity, grace and ability with which he has conducted the work, and are grateful for the courtesy with which he has treated us, and for all the hospitality and kindness that we have received in America."

Mr. Preece: "I move that a vote of thanks be accorded to this fine old man, as the newspapers call him, but who is in reality a younger man than myself." The motion was unanimously carried and Prof. Gray responded as follows: "I cannot tell you how gratifying this is to me. I have worked for the last two years in organizing this congress under many difficulties and those difficuties have continued right up to the present moment. Those steam engines outside do not even give us a chance to express ourselves. I want to thank you before we leave, I want to thank the members of this congress for the part they have taken and I want to thank you for the good part in which you have taken all the difficulties under which you and I have had to labor. I think on the whole the congress has been very successful and I trust you will go away feeling that this is true, and that you will think of us kindly; and you, gentlemen, who come from foreign shores, when you go home and look back, do not think only of smoke, of noise, and of high buildings, but think of us over here as having warm hearts, as wishing you well, and that we are all praying that you will have smooth seas and a warm-hearted welcome home to your friends and dear ones. Now, gentlemen this closes the work of the International Electrical Congress at Chicago in 1893, and I now declare the same adjourned."

Nikola Tesla's Lecture.

Mr. Tesla's lecture on "Mechanical and Electrical Oscillators" was delivered in Assembly Hall at the southwest corner of the Agricultural Building at the World's Fair grounds on Friday evening as announced in the program. Every member of the congress with one or two exceptions was present and the greatest interest was manifested in the experiments that were shown.

It was twelve minutes after eight when Prof. Elisha Gray introduced Mr. Tesla to the audience in the following words: "I came down here to-night for the purpose of introducing to you a gentleman whose name needs no introduction as it is a household word with all electricians, but I wanted to do him the compliment of coming here as the official head of the World's International Congress of Electricians and to extend to him the compliment of an introduction for them as well as for myself. This compliment loses none of its force when I tell you that I have another official duty to perform to-night and it will be necessary for me to leave immediately, but if I should follow my inclinations I should stay, for no one wants to hear and see these experiments more than myself. I have the honor, ladies and gentlemen, of introducing to you Nikola Tesla. I wish to add one word, inasmuch as I have to leave; I am going to ask Dr. T. C. Mendenhall to do the honors for the rest of the evening."

Immediately the hearty applause subsided Mr. Tesla said: "Ladies and Gentlemen: We are told in a delightful anecdote how, many years ago, when science was still in its infancy, a man to whom the world is largely indebted for the discovery of a great truth was meditating in his garden when the idea came to him, and how on that occasion he was carried away by his enthusiasm. Be that an actual fact or not it is certain that the search for truth through the centuries that have elapsed has exercised an immense power on the imagination of man. It seems as though we are actual witnesses of the researches and experiments made by the discoverers and inventors of ages gone by, and that we are almost in a condition to know how they felt at the moment of sublime inspiration.

"I am sure in this audience there are many who have felt this most exquisite pleasure and whose presence here will forever fix the recollection of this evening upon my mind. To feel this pleasure is accorded to but few; however, I can say myself that I have felt it and am still under the impression of the pleasure which the accomplishment of a few insignificant thoughts that have come to me and the speculation on the possibilities of their future development have caused. In these results I am, inventor like, quite taken up, and I hardly dare hope to be able to develop them as I wish, but I feel that I must explore them; and again I have doubted my ability to present them satisfactorily. Yet I am sure of the practicability of investigations in this manner from the few results I have so far obtained.

"I can best tell you what I have attempted if I comply with the scientific duty and tell you exactly the history of these inventions. It was at a time when I was strenuously endeavoring to solve a question or two which was considered insolvable, first, Was it possible to operate a motor without sliding contact, and second, was it possible to develop constant currents in a certain direction? I found the solution to the one problem and produced dynamos without commutators and that success emboldened me to go ahead and apply whatever of knowledge and experience I possessed to the solution of the other problem.

"On the occasion of my first visit to this country I stepped into the exposition at Philadelphia and I saw there a very thick copper washer provided with handles that visitors would move within a magnetic field. That day it occured to me that when the plate was moved slowly in the field there was experienced resistance, and that when the plate was suddenly pressed in there was a rebound as though it struck against something solid. After returning from the exposition the thought occurred to me that if I took a conductor and moved it into the field and then rapidly withdrew it, I could in this way obtain whatever of electro-motive force there was. In the first place I was impressed with the analogy of this device to the induction coil, in which the same process takes place. When we impart current to the primary circuit we put lines of force slowly into the field and when we break the current we take the force swiftly away. I began to think of a mechanism which would be capable of fulfilling these conditions.

"During my work with induction coils and motors which succeeded I became familiar with currents of high frequency, and then I clearly realized the problem before me. I convinced myself that in alternating distributions we must induce currents of more than one phase and that we must have a better organization and a perfected mechanism capable of rendering the current into steady oscillations before we could obtain the desired results. Here then I was confronted with this difficulty. I constructed small machines of the ordinary type which enabled me to investigate, but when I endeavored to construct machines with a greater number of alternations for higher frequency I found that I met insurmountable mechanical difficulties.

"And then the idea came up and I asked, how it would be if I took a very strong field and reciprocated very rapidly a conductor in that field, would I not have a similar machine and one which would not involve loss in the iron? And now I began to consider this matter very seriously and later I considered this question, knowing what has been done in the field of harmonic telegraphy and supposing that instead of the ordinary dynamo we take dynamos constructed like the pendulum of a clock and on a harmonic vibration principle, would we not then obtain alternating currents of a perfectly defined and absolutely constant period, which it is impossible to accomplish with an ordinary machine because it possesses so great inertia? And then again I thought like this, with such powerful machines there is a possibility of transmitting energy through the air and by means of this energy of transmitting messages. This, then, is one of the mainsprings which has driven me into this work."

Here by means of diagrams Mr. Tesla described the construction of the engine which he has invented for producing these absolutely constant oscillations and which is operated by compressed air under 100 pounds pressure and delivered at the rate of 40 cubic feet per minute. One of these engines having a diameter of about two inches and a half and of about that length operated a small motor and has a capacity of nearly one-half horse power. After this Mr. Tesla showed the operation of the larger engine having a piston and plunger weighing 20 pounds which was oscillated at the rate of 78 times a second, and stated that 5,000 or 10,000 oscillations per second could be as readily produced. The next experiment was made by attaching a horse shoe magnet having a wire about two feet in length inserted through it to show the vibration to the plunger of the engine. The engine was then set in motion, a current communicated to the magnet through wires attached to the nodes of the magnet wire. A copper disc revolving on an axis was then introduced by Mr. Tesla between the poles of the magnet while the same was being oscillated by the engine. The result of the experiment was that the copper disc began slowly to revolve, thus disproving the theory that there is no electro-magnetic force at work in the disc and that the force was simply one produced by induction as has been believed universally heretofore.

Mr. Tesla next attempted to show an experiment with what might be called a three coil generator, but the apparatus had been damaged in some way and refused to work. The next experiment was one with a large engine similar to that last described, having attached to the plunger of the oscillator a core of iron which played through four field magnets excited with a current at 5,000 volts from the Westinghouse plant. A current was generated by the apparatus, and was used to run a small registering motor, thus proving that generators can be constructed on the ideas evolved by Mr. Tesla in accordance with these more recent experiments, and having an absolutely constant current. It should be added that one of the claims made by Tesla for these oscillators is that the period will not be varied after the machine is started, whether the pressure be 10 pounds or 100 pounds, and that the electrical currents produced from small units will oscillate just as the pendulum oscillates, and be unaffected by the circuit load or any imaginable condition. The oscillators are so constructed that they can be adjusted so as to run with practically no noise, and with the entire absence of any pounding effect.

Receptions to Members of the Congress.

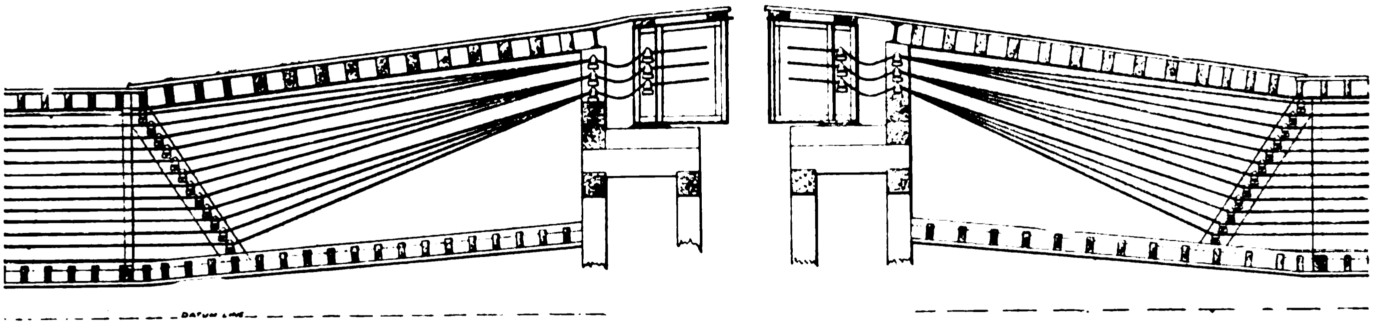
Saturday the members of the congress spent at the Fair, for whom special entertainment was provided. The reception given to the congress by Mr. W. H. Preece, president of the English Institute of Electrical Engineers and commissioner from England, at Victoria House, was largely attended. At 10 P. M., members of the congress were invited by the Department of Electricity to a collation in the north gallery of Electricity Building. A part of the gallery had been set apart for the guests of the department and the good things the worthy chief had provided. When all had been served, Prof. Barrett proposed the first toast which was responded to by Dr. Hornsby; Prof. Elihu Thomson, Dr. Emery, Prof. Houston, Mr. Decamp, Prof. S. P. Thompson, Prof. G. R. Barker, Mr. Weston and Dr. Keith spoke of their impressions of the Fair or the Congress.

The California Midwinter Exposition.

The general landscape and outline plans for the grounds and buildings of the California Minwinter Exposition have been decided upon by the executive committee. The designs for the buildings will be specially Oriental or Moorish, Aztec or early Spanish mission. The ground areas of the buildings will be, Manufacturers and Liberal Arts 450 by 200 feet, Fine Arts 120 by 60 feet, Agricultural and Horticultural Hall 300 by 125 feet, and the Administration 60 by 40. The sizes may be enlarged later by annexes according to the space required by the exhibitors. Special arrangements have been made by the management with the railroads for the transportation of exhibits and special tracks are being laid into the park for the transportation of goods, building material, etc. Negotiations are being made with foreign countries for exhibits.

The Underground System at the World's Fair.

As the visitor approaches the World's Fair at night he sees every part of the grounds lighted and as he watches the brilliant effect he is too much absorbed in the scene to think of the means employed to distribute the thousands of electrical horse power used over so large an area. As he walks about the grounds he notices the ornamental lamp posts standing out neatly, unencumbered by any overhead wires and with no visible communication with any source of power. In Electricity Building he sees hundreds of horse power of machinery and lights operated by the same force. In the Manufacturers and Liberal Arts Building he rides to the roof 250 feet above the floor in an elevator raised by this same force.



ELEVATION OF WIRING CONSTRUCTION

FIG. 1.—THE UNDERGROUND SYSTEM AT THE WORLD'S FAIR.

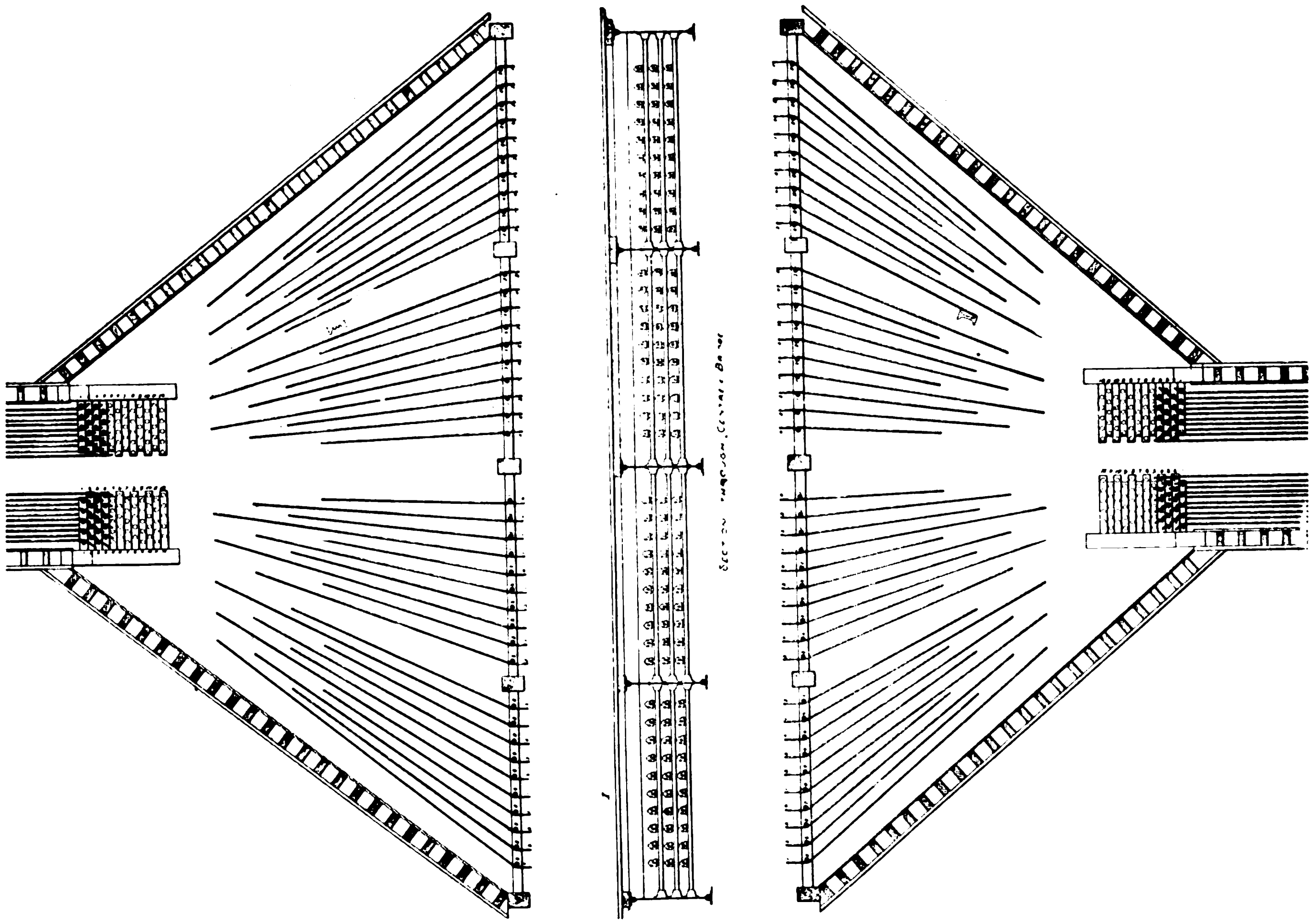


FIG. 2.—THE UNDERGROUND SYSTEM AT THE WORLD'S FAIR.

For the distribution of the electricity for lighting, power, telephone, fire alarms and telegraph systems plans were considered early in the preparation for the Fair and the large subway that reaches from Machinery Hall annex to the Fisheries Building with the various branches and connecting ducts was constructed. The visitor walks through the Government Building through the west side of the Manufactures and Liberal Arts Building, across the plaza in front of the Government Building, quite unconscious of the sub-way beneath him, carrying power and light to the buildings and grounds or of the workmen who in the ground under him are inspecting the many lines of cables in this underground passage way. To the visitor of a practical turn of mind, a visit to this giant subway will be of interest as it is one of the great engineering features of the Fair.

In its construction a number of things were necessarily considered; its size, strength, ventilation, drainage, protection from fire, and also its temporary character, while in planning its course through the ground many difficulties were met with incident to the character of the soil and the crossing of other systems of distribution.

The subway is built of plank two inches in thickness spiked to three by eight inch timbers set 12 inches apart. Over the inner edges of these timbers is fastened expanded metal lathing which is covered with cement offering an incombustible surface on the inside. The main sections of the subway are six feet six inches square. From Machinery Hall to Electricity Building the sub-way is double. From the Electricity Building a branch extends to the Mining Building while the main line of sub-way runs east toward the Manufactures and Liberal Arts Building. It passes then under the Manufactures and Liberal Arts Building on under the Government Building to the Fisheries Building in a course as illustrated by the heavy black lines shown on the map Fig. 3. As the cables stop at the various buildings or are run off to the various parts of the grounds along its course the subway is gradually reduced in size toward the north end.

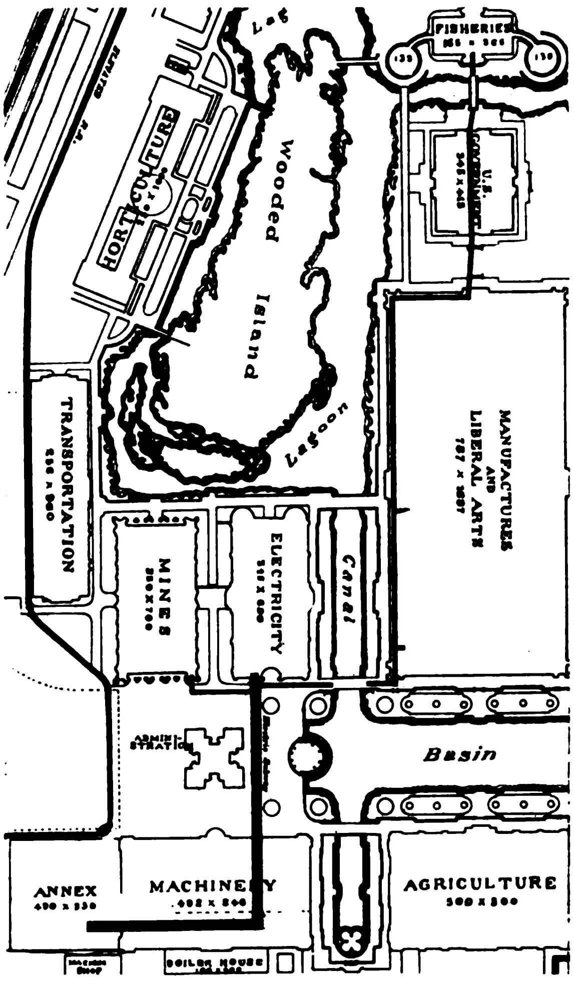


FIG. 3.—MAP SHOWING COURSE OF SUBWAY.

The top of the subway is but a short distance below the surface of the ground, about 20 inches on an average. It is entered through trap doors in the floors of the buildings and through manholes on the ground. One of the problems that the engineer encountered was the crossing of the lagoon and the plan adopted which is illustrated in the accompanying cuts, Figs. 1 and 2, shows the ingenuity displayed in meeting this problem. The subway widens as it approaches the lagoon and the wires are spread out and suspended from the under side of the bridges which cross the lagoons at those points. The subways are open at these ends for ventilation.

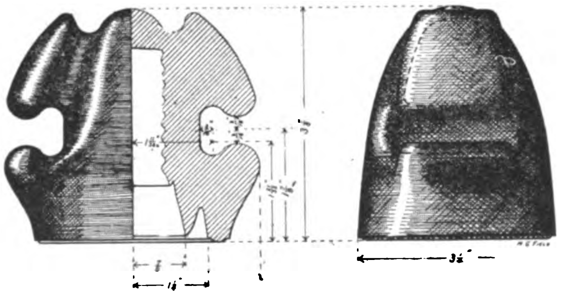


FIG. 4 —THE PIERCE INSULATOR.

The method employed of running the wires holds them firmly in place and also permits easy access to any and all wires. About every thirty feet along the walls are iron frames in which are sockets for supporting the oak cross arms. Each arm holds five pins on which are screwed double Pierce insulators of the design shown in Fig. 4.

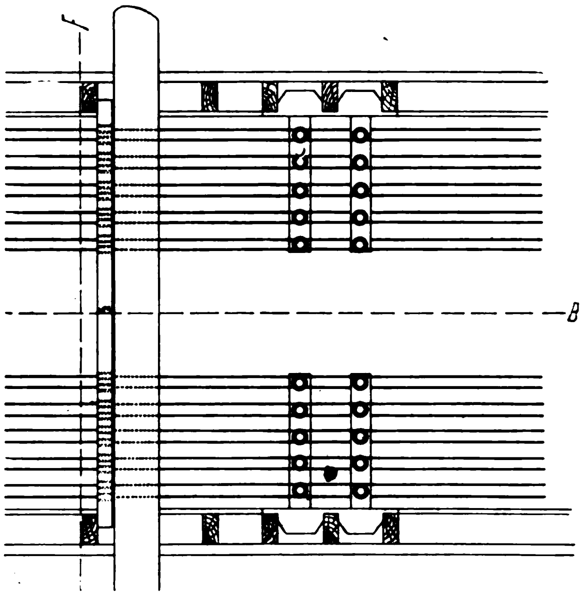


FIG. 5.—PLAN SHOWING POSITION OF WIRES AND PASSAGEWAY.

There are 12 cross arms on each side between which is the passage way for the inspector and workmen. Each section of the tunnel will hold 240 cables when of full size. At its smaller end near the Fisheries there are in place but 20 insulators. The total length of single subway is 6,915 feet. From Machinery Hall to Electricity Building the subway is double a distance of about 1,000 feet. It is well drained and the 16-candle power lamps which run 5 in series from 500 volt mains furnish abundant light for the workmen.

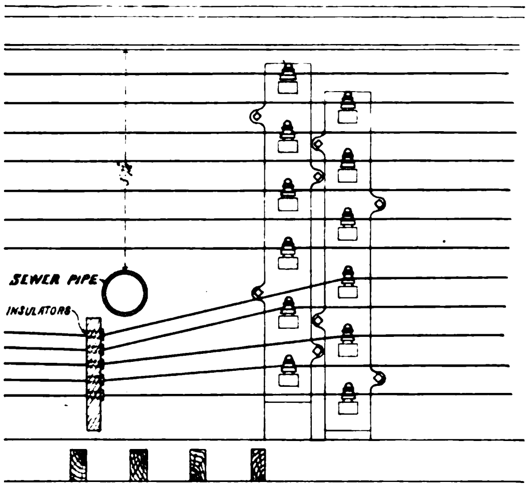


FIG. 6.—ELEVATION SHOWING WIRES.

From printed cards showing a cross section of the wires the circuits are easily found. The power, incandescent and arc circuits are grouped separately. The telephone and fire alarm cables are separately attached to the wall. For conveying the cables from the subway to the different parts of the grounds where the electricity is to be utilized pump logs are laid; except where the wires enter the buildings where vitrified soil pipe is used. For carrying the wires from one lamp post to another, ducts or pump logs are used which have recently fulfilled their object very well, although early in the spring considerable trouble was had with them.

Electric Railway Plant of the Chicago North Shore Railway Company.

The electric railway system of the Chicago North Shore Railway Company is now in complete operation. It is affording rapid transit to the district in which it is operating and will be greatly appreciated. The road is fully equipped, is doing an immense business, and serves as an important feeder to the Yerkes cable system on the north side. The establishment of this system of electric lines brings the trolley wires comparatively near the center of the city.

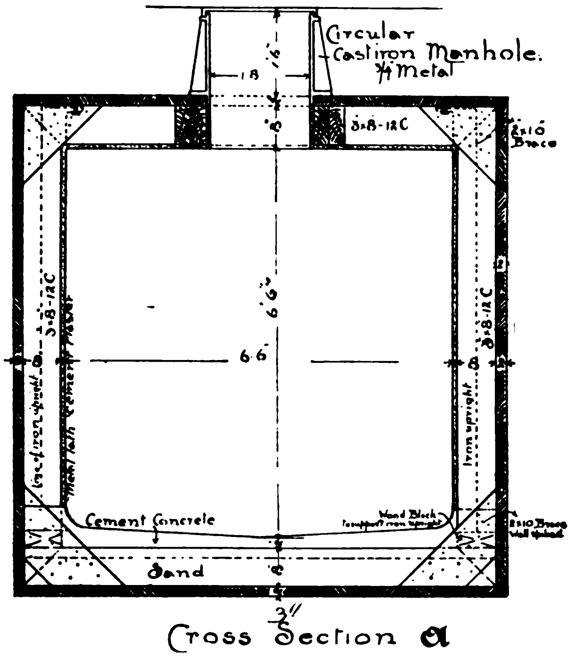


FIG. 7.—THE UNDERGROUND SYSTEM—CROSS SECTION OF SUBWAY.

The operation of the line has been very satisfactory from the commencement. The motormen were carefully selected by Superintendent Fredericks, and have been very carefully instructed, being made familiar with their duties before they were placed in charge of motors. The building of this line has extended over some months. The point of commencement is at the terminus of the Evanston Avenue horse car lines, running thence to Argyle Park, Edgewater and to Evanston, making a direct double track line from the city limits to Evanston, a distance of about six miles, trains running on schedule time of twenty-five minutes.

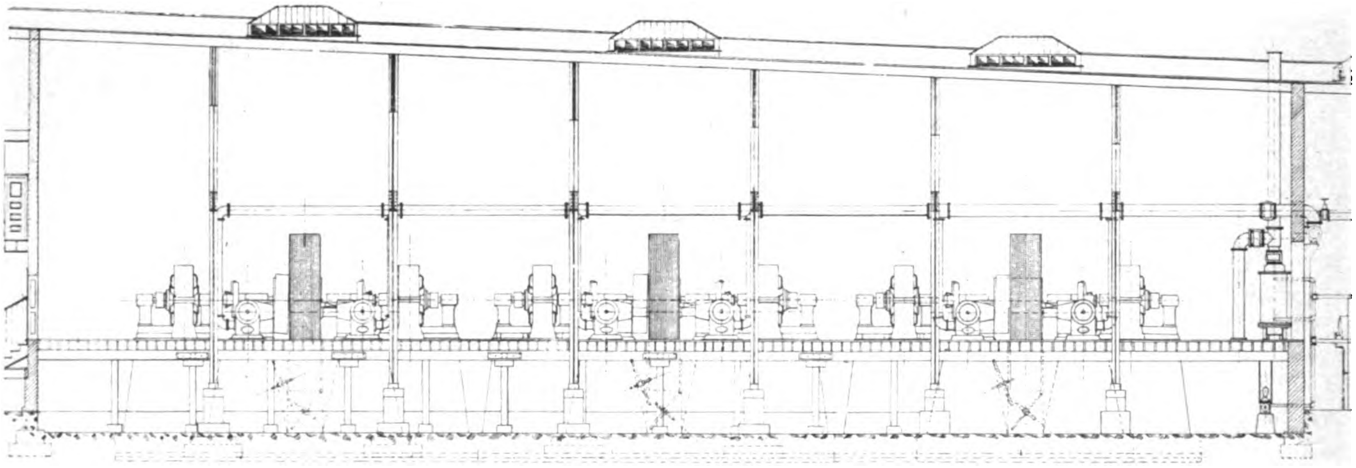


FIG. 1.—ELEVATION OF DYNAMO AND ENGINE ROOM.

The company is about to obtain extensive franchises in Evanston and will continue its fine equipment throughout the principal thoroughfares of that city. Fifty-six cars are now in operation on busy days, the motor cars being driven by two twenty-five horse power motors each. The cars were manufactured by the Pullman company. The building in which the power plant is located is of elegant design, situated in the northern part of Edgewater, and in the most central location that it could be placed for the operation of the entire line, the dimensions of the structure being 150 by 230 feet. The exterior appearance of the building is very beautiful. On the first floor in front are the general offices, vaults and storage rooms, while above Mr. D. H. Louderback, the president, has a very extensive office, opposite which is the directors' meeting room.

The material is red pressed brick with terra cotta and stone trimmings. A flat trussed roof covers the station with large sky lights. The inside dimensions of the boiler room are 55 by 100 feet and is designed to contain eight water tube boilers of 200-horse power each. The boilers are all equipped with smokeless furnaces and large coal bins are placed next to the railroad track. The stack is of steel, 150 feet high; 19 feet at base with an eight foot flue. The gases from the boilers are led to the stack by means of iron breeching. Wainwright feed water heaters are employed to heat the feed water. The engine room equipment, because of its novelty, will be interesting to all street railway engineers. The dimensions of this room are 100 by 130 feet and is finished in tile. Twelve engines, comprising six pairs, will eventually be operated in this station.

At the present time one pair is in operation, which are of the improved Wheelock type, equipped with Hill valve system and are running 105 revolutions per minute with 101 pounds steam pressure, the horse power, under these conditions being 900. The fact that the Wheelock engine can be stripped with great ease and rapidity so that repairs may be made is one of the commendable features. The fly wheel is 16 feet diameter, weighing about 35,000 pounds. The rim of the wheel is grooved for 21 wraps of one and one-fourth inch rope, connecting rods are solid steel forgings with cast steel boxes filled with magnolia metal, the crankpins are six inches diameter by six and a half inches long. The crossheads are of cast steel; the piston rods are four inches diameter; the crankshaft is a hammered steel forging 12 inches in bearings and 14 inches in hub of wheel; the main bearings in the frame are to accommodate the 12-inch shaft and are 24 inches long; metallic Golden Rod packing is used throughout the engine and Wheelock packing in all pistons; disc cranks are employed, being of cast steel. The station is designed to accommodate 12 generators of the General Electric multipolar type. The accompanying illustration shows only six of these machines in position as part of the engine room is now being used temporarily as a car barn. Each generator running at 425 revolutions per minute develops 400-horse power.

The switchboard for the station is designed to be located in the centre of the engine room so as to be easy of access. The engine and boiler rooms are lighted by arc and incandescent lamps from a separate plant. The transmissions from the engines to the generators, which is a departure from ordinary practice, was introduced by Messrs. Hoadley Bros., of Chicago. The particular system employed is that of Mr. J. H. Hoadley, which is known as the compound wind, and has been used extensively on the Pacific Slope. The driven pulley runs 425 revolutions per minute being grooved for 32 wraps of one and a quarter inch rope and driving the two generators.

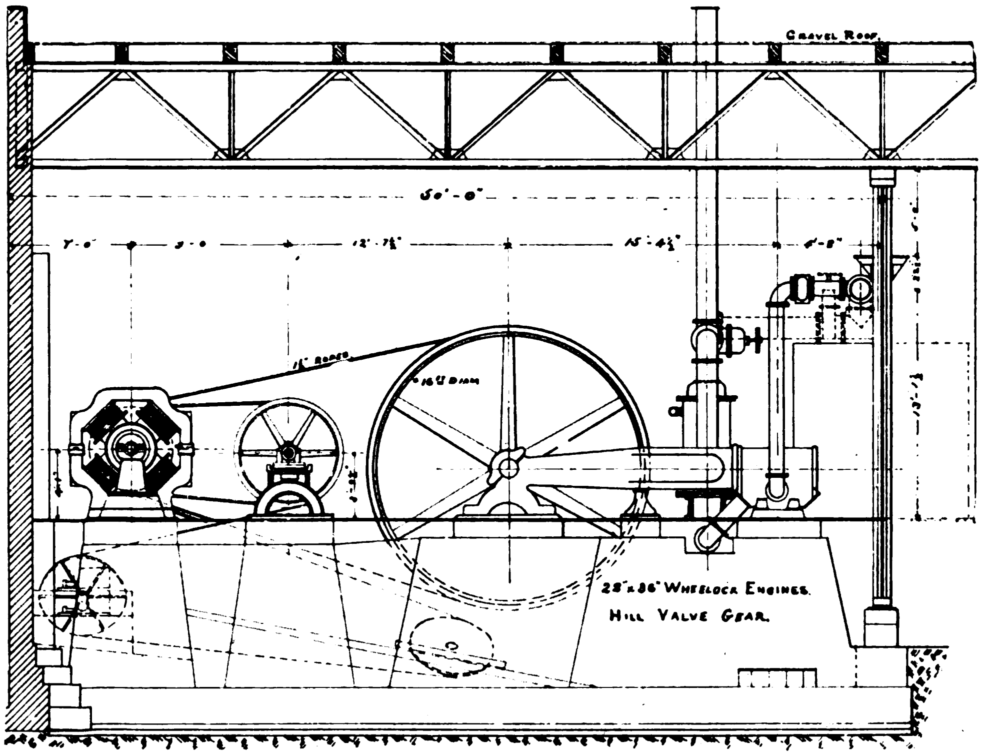


FIG. 2.—ELEVATION SHOWING ROPE TRANSMISSION.

The compound multiple winder situated between the engine and driven pulley, is grooved for 11 wraps of one and a quarter inch rope; the stationary tighteners and traveling winder are all placed beneath the floor. The distance between centres of shafts in this case is only 26 feet. This transmission is designed to transmit 1,000-horse power under great variations. The success of this transmission proves conclusively its adaptation when properly applied, and it is a noticable fact that the fly wheel face is only 38 inches in width, thus giving a very short span between bearings. The rope looks like an endless steel rod after being lubricated with Bichette rope dressing, and its operation is almost noiseless in spite of the heavy loads thrown on the machines.

The California Engineering Co., of Chicago, were the contractors, and this plant seems to be worthy of the same praise as in the successful operation of the electric station of the Chicago City Railway Co. The officers of the Chicago North Shore Railway Co. are: D. H. Louderback, president; J. L. Cochran, vice-president; Howard Abel, secretary. The other directors being Samuel Insull, B. E. Sunny and A. D. Wheeler. B. J. Arnold is consulting engineer. The plant is now operated under the efficient hand of Superintendent Fredericks with T. North, chief engineer.

A New Subway System.

Mr. Solon Howe of Detroit has devised a new system of subway for electric wires and for water and gas pipes. Mr. Howe does not propose to patent the system but will nevertheless endeavor to have it introduced. He will provide complete working plans of plants at a reasonable price according to the size and intricacy of the system.

For crowded streets he proposes a subway eight feet high and six wide in the clear built of brick or of U shaped steel walls and roof on a concrete base. He proposes to carry the wires in troughs on insulated brackets placed on each side leaving place for water and gas pipes beneath and an open space in the center as a passage way. For side streets he plans to carry the wires in a duct of vitrified tubing laid in concrete in a wooden box, which will be surrounded by broken stone and properly drained.

The man hole is to be built of brick with a cast iron cover or entirely of cast iron. The estimate made by Mr. Howe for six by eight foot subway of brick and steel with water and gas mains or duct and shelves for wires and cable laid under conditions similar to those at Detroit will cost from $38.00 to $40.00 per linial foot. The U shaped steel tongue will cost from $25.00 to $28.00 per foot. The four by four foot brick main walls six feet deep with all appliance $60.00 and the steel main walls $45.00 each. The round cost of the six by eight subway system is placed at $100,000 a mile.

Invitations are out to the 15th Annual Rhode Island Clam Dinner tendered to the electrical fraternity by the American Electrical Works of Providence. The dinner is given at Haute Rieve on Saturday, September 2nd.

Electrical Industries.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

The pleasant weather, the congresses at the Art Institute and the numerous special attractions at the Fair have helped to increase the attendance. The total paid admissions for the month exceed three and one-half millions or a daily average attendance of nearly 114,000. The fourth week of August has the record of over one million paid admissions, the largest attendance during any one week of the Fair. The two last months of the Exposition are considered by all, the best months, and a much larger attendance is expected for each of these months.

The preparations for testing the electric trolley system of propelling boats on the Erie canal, to which Governor Flower has given so much attention and through whose influence an appropriation of $10,000 was secured from the state, are according to reports progressing rapidly. Both the General Electric and Westinghouse companies are equipping a section of the canal for testing their systems, the General company a section near Albany, and the Westinghouse near Rochester, N. Y. The boats will be equipped with motor, operating a screw propeller, the electricity being conducted to the boats by a trolley wire. The maximum speed will be five miles per hour.

The fourth International Electrical Congress and the first held in the United States has become a matter of history. It was the event of the past month around which the attention of the electrical world was centered. The attendance from the beginning of the congress on Aug. 21st till its close on the 25th was fully up to the expectations of its organizers. The papers presented, both practical and theoretical, were of interest and value. The discussions that followed the presentation of many of them brought out a large number of new ideas and showed the enthusiasm of the members in the work of the congress. The most important work of the meeting, however, was that done by the chamber of delegates, made up of representatives appointed by the governments of the principal countries. It was for the ratification of accepted standards the establishment of new units of value, and a clear definition of these units by the official representatives of the different countries that brought the congress into existence. The report of this chamber of delegates, found in another column of this issue, will undoubtedly be of great interest to our readers. A very graceful compliment to this country, and one of special significance, when it is considered that it was done at the instance of foreign delegates, was the adoption of the definition and value of the unit of induction to be called the henry. The influence of this congress will extend as the members return to their homes, and as the reports of the proceedings are circulated by the technical papers and by the different electrical societies. It will occupy a prominent place in our electrical history both on account of the work accomplished and on account of the men present. Probably never before was there held such a gathering of representative scientific and electrical men. The presence of Dr. Von Helmholtz, who has witnessed and aided in the development of electricity from the time when the very evidence of the enistence of the electric current was very slight, to the time of the construction of 10,000 light dynamos, is an honor which this country should appreciate. The delegates from England and France, also those from Switzerland and Italy, were well known to the western world through their work at home, and the pleasure and honor of this visit, as well as the many ideas they have left on this side, will make their presence long remembered, and we trust that this will not be their last visit to the United States.

There has always been something magnetic about the word electric. It seems to convey to the public mind some hidden force which in some mysterious way is going to benefit all those who are in any way connected with it. There has been a time when the projector of an enterprise had but to connect the word electric to his scheme and support for the enterprise was immediately assured. This fact has been especially true in the construction of electric railroads between neighboring towns in various parts of the country. The promoters of these enterprises, no matter what their past experience or financial standing, have secured large amounts of money. The case of the Chicago & Central Indiana Electric Railroad, which recently collapsed, shows, however, that it is losing its attraction. The projector, E. J. Pennington, of Mt. Carmel, Ill., whose previous projects include the invention of a flying machine that never flew, secured from small investors sufficient money to commence his enterprise, but the funds did not last notwithstanding the bright future promised for the road, a magnificent equipment, a speed of 150 miles an hour, etc., etc., and the collapse followed.

Europe receives a large percentage of its tourists and pleasure seekers every summer from the United States. The ocean greyhounds fitted with everything that will add to the comfort and pleasure of the passenger make the voyage easy and agreeable. Europe has been traveled over for so many centuries that the highways of travel are equipped with hotels and other accommodations. The railroads carry the tourist into the heart of the Alps where he can find guides and the means of pursuing his journey to the tops of the highest peaks. It has many times been said that the United States possesses scenery unsurpassed by any part of the world. But to reach these parts of the country, to pass up the canons and to climb the mountains the traveler is dependent upon his own resources. A saddle horse carries him from the nearest railroad station and pack animals carry his tent and provisions. But few of the people who visit Europe each year would undergo the fatigue incident to a trip of this kind. The west is growing rapidly. Many schemes for its development are put through in an astonishing manner. The tourists and pleasure seekers are increasing every year as the means of travel improve and the accommodations for the traveler increase. About Pasadena, California, in the Sierre Madre range is some remarkable mountain scenery so much admired that it has been called the Pasadena Alps. Through the energy and far sightedness of Mr. T. S. C. Lowe there has been constructed a line of road from Pasadena to the summit of the mountains. Electricity is used as a motive power both on the trolley lines and for driving the cable on the incline. Hotels and pavilions have been erected and the number of visitors already point to the success of the road. Other electric roads will undoubtedly follow until at some future time every part of the western mountains will be easily accessible to the tourist.

THE increase in speed of street cars is attended by a corresponding increase of danger to human life. It matters not by what power the car is propelled, the same danger is present. The large number of horse lines that have been changed to electric lines, have before people become accustomed to the sudden increase of speed caused many accidents, but proportionately few accidents have been caused by the electricity itself, in fact, such an occurrence is rare. The need of employing only the best material and of systematic and careful inspection of the cars is shown by an accident that occurred recently on a grade at Malden, Mass. The car had but just started down the grade when the motorman found that for some reason the brake would not work. When partly down the grade the car jumped the track, and continued down the street several blocks. The conductor and the half dozen passengers held to the car, until it was evident that their only hope of escape was to jump, which they did before the car reached an embankment some twelve feet high that lay in its path. The last passenger had hardly jumped before the car went over the embankment into the field below. The escape of the passengers from fatal injuries was remarkable. It will require a good many fares to repiace the damage done. Careful attention to the brake and a test before the car begins to descend the grade, will make such accidents extremely rare.

The Love Electric System in Washington.

BY M. D. LAW.

It is an acknowledged fact that the operating of cars by electricity is the best-known method. This is amply proven by the amount of trolley construction that has been accomplished in the last few years. The serious objection to the overhead trolley is the danger attached to bare conductors strung over city streets. This is overcome by the use of the Love underground trolley, which is nothing more or less than the trolley wire transferred from the space above to the space beneath the track by suitable mechanical devices, and by the use of a metallic circuit.

It has been found in practice that the use of a metallic circuit will make a saving of from twenty to thirty per cent in the consumption of coal, as it gets rid of the resistance of truck, wheel, rail and bad bonding, while with the metallic circuit the current is fed direct to the motor without loss. The cry has been raised that it would be impossible to operate underground trolley lines for the reason that the accumulation of moisture would be so great, that too much current would be lost; but such is not the case. It has been found in practice that not the slightest current leak can be found on such a line, even after long-continued heavy rains, and where the track has been entirely covered with water.

A line of the Love underground trolley system was started in Chicago, March 1, 1892, and has run successfully ever since. On March 2, 1893, a double track line, one and one-half miles long, was started here, in Washington, by the Rock Creek Railway Co., and has run every day s nce, with less trouble than has been experienced in overhead construction. In fact, I never started a plant that operated so successfully from the start as this one has. This line is an extension of the Rock Creek railway, which runs from Eighteenth street and Boundary to Chevy Chase, with overhead construction, a distance of six and one-half miles; at Eighteenth street it joins the underground line, and extends down U street to Seventh. The same cars run through from one terminus to the other, the underground trolley being taken out or put in at Eighteenth street, this change being accomplished with but a few seconds delay.

The Love underground system consists of an open conduit, both positive and negative wires being carried in a thoroughly protected place beneath the slot rail. The yokes, for the support of the slot and tram-rail, are made of cast iron, and weigh 260 pounds each, and are so arranged that eight three-inch tubes may be placed in the roadbed, for use as feed wires or any other electric cables. They are mounted on concrete foundations and concrete is used for the bottom of the conduit, while the sides are of cast iron. The depth of the conduit is twenty inches, with a width of fourteen inches in its widest part. The width of the slot is five-eighths of an inch. The slot-rail is so arranged that it may be quickly taken up or put down, without removing the pavement. It is U shaped, with a long lip which thoroughly protects the insulators and wire from all water. Should the car leave the track this slot-rail will protect the line from any injure as it takes all the blow from the trolley. Manholes are located every 100 feet, and each man-hole has sewer connection, which allows ample drainage.

A complete metallic system of conductors is used, consisting of 0000 capacity, hard drawn copper. This wire being special drawn, with a groove in each side, to which the insulator clamps are bolted, this allowing a perfectly smooth surface for the trolley wheel, eliminating all spark. The insulators are moulded mica, and are attached to the yokes by a special device which allows for expansion and contraction.

The conductors or trolly wires are cut every five hundred feet and a special device so arranged with heavy compression springs that all expansion or contraction is automatically taken care of at these points. Special plug switches are so arranged at these points that any section of wire may be cut out, thus allowing of quick location of any trouble and repairs while the road is in operation.

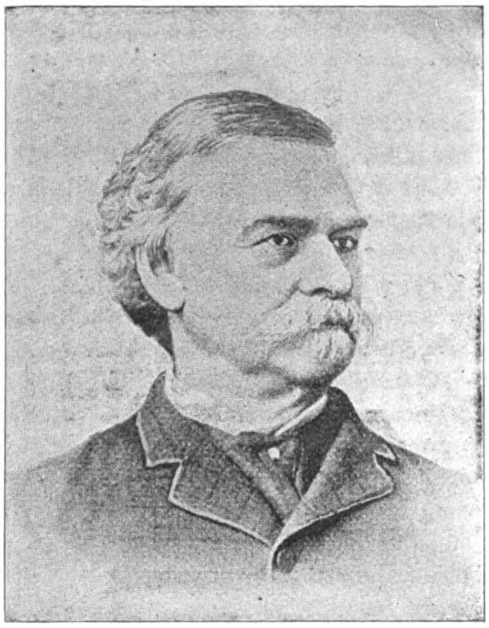
The trolley is an ingenious mechanical device, the arms of which have all the movements of the human arm, or the sholder, elbow or wrist movement, allowing it to always follow the wire as readily on curves as on the straight line. The trolley carrier for holding the trolley underneath the car is an equally ingenious device, allowing the trolley leg to always remain in the center of the slot, so that it will not bind on curves. It will thus be seen that the system is made up of mechanical devices, to transfer the regular 500-volt trolley system from the space above to the space beneath the track. The only electrical feature being the retaining of the current.

The Western Electric Company's scenic theatre in Electricity Building is one of the most drawing features of any exhibit at the Fair. It is estimated by Mr. A. L. Tucker who deserves the credit for the entire installation that fully 5 per cent of the total number of people in the grounds either enter the theatre or apply for admission. Fully 3,000 people enter the theatre per day, which is its fullest capacity, there being over 2,000 more turned away each day.

Obituary—Louis W. Burnham.

There were few men more widely known and whose acquaintance was more highly esteemed in the electrical trade than Louis W. Burnham whose death occurred August 9th at his residence in Dorchester, Mass. Born in Canterbury, Conn., in April, 1831, he was consequently 62 years of age. Until he was 20 years of age he remained at home at various employments when not in school. At the age of 20 he went to West Brookfield, Mass., where he remained three years in the employ of Col. Jno. M. Fisk in a large general merchandise establishment.

He gave considerable attention to penmanship and soon became an expert penman. His health being somewhat impaired he gave up his position at West Brookfield and gave lessons in writing to classes in various parts of New England and the middle states. During the winter of 1853 after having been connected with several academies and seminaries in the east he engaged to take charge of the writing department of the New York Conference Seminary in Schoharie County, New York, the school at that time having over 800 students.



LOUIS W. BURNHAM.

Two years later he entered the Mercantile College at Worcester, Mass., from which he graduated in May, after which he opened a commercial institute at Rockford, Ill., which he conducted with marked success for six years, during which time he was elected city clerk of Rockford and devoted much time to the study of law. In the spring of '61 he opened another school at Freeport, Ill., which was also very successful.

In the summer of '62 on account of the ill health of his family he gave up his position in the west and returned east where he was appointed principal of the Commercial Department of the Hudson River Institute at Claverack, N. Y. Later he opened the American Business College in Springfield, Mass., which became a popular institution. Owing to failing health Mr. Burnham was obliged to give up his occupation and accepted the management of the New York Life Insurance Company's agency for New England.

In 1881 he assisted in the organization of the National Electric Gas Lighting Company and was elected its president and manager, which in the following year was reorganized under the name of the Electric Gas Lighting Company. He held the position as president and business manager until 1886 when he was elected vice-president and manager.

After this up to the time of his death Mr. Burnham devoted his whole time and energy to the trade interests of the company and it was largely through his indefatigable energy and perseverance that the Electric Gas Lighting Company has been built up to the large and prosperous concern that it now is. He leaves a widow and three children, a son and two daughters. The son, Mr. W. W. Burnham, is treasurer of the Electrical Gas Lighting Company.

Gas Engines as Applied to Electric Light Work.*

BY GEO. A. FARWELL.

I shall not refer to the advantages or disadvantages of the different types of gas engines in use, but simply give you some of my experience with the one I have had running for the past year in the station of the Waukesha Electric Light Company. This is a 100-horse power, two cylinder Otto Gas Engine. The cylinders are horizontal, one directly above the other. The connecting rod from the upper piston takes hold of the crank pin, while the connecting rod from the lower piston is attached to the upper connecting rod, some distance back of the pin. The supply valve to the cylinders are disc valves, opening inwardly, and are held in their seats by light spiral springs.

The exhaust valves are flat valves, which are opened by a cam. The governor regulates the speed of the engine, and controls the admission of gas to the cylinders. There is a gas bag between the meter and the engine to insure an even pressure. The gas pipe from the meter to the gas bag is 4 inches in diameter. The gas is ignited by an electric spark produced from a four cell Edison Lelande battery. A water jacket surrounds the cylinder to prevent over-heating.

There is an exhaust pipe for each cylinder. Naturally the motion of the engine would be somewhat unsteady on account of the force of the explosions but this disadvantage is entirely overcome by a heavy pulley, and fly-wheel on the engine; and by the use of a countershaft carrying a heavy balance wheel. The engine runs at 160 revolutions per minute and the balance wheel 690. This insures steady motion at the dynamos. The speed of the engine can be increased or decreased at will, by manipulation of the governor. While the engine is running the amount of gas it consumes is regulated by the governor, for the varying load it carries.

It is a simple matter to record correctly actual expense in generating power for running dynamos with a gas engine. I have a countershaft, to which are belted one 100-horse power gas engine, one 100-horse power steam engine, one 80 light arc dynamo, one 75 light arc dynamo, and one 600 light incandescent dynamo. By the use of clutch pulleys, I can run any one, or any two, of the dymos with either engine, or I can run any two of the dynamos with either engine, and the other dynamo with the other engine, or I can run the three dynamos with both engines at the same time. I generally start up with the gas engine running the commercial arc dynamo and the incandescent dynamo. When it is time to turn on the street lights, I start the steam engine, switch the commercial arc dyanmo and the incandescent dynamo off of the gas engine, on to the steam engine, and the street lights on to the gas engine. I have too much load for either one of my engines to carry it all, but when it is so that one engine can carry it, I make the gas engine do the work.

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* Read by Mr. Geo. A. Farwell, superintendent of the Waukesha Electric Light Company, before the Northwestern Electrical Association.

It is a well known fact that when illuminating gas is burned in a gas engine to drive a dynamo, very much more light can be produced, than can be produced by burning the same quantity of gas in burners in the usual way. For instance, four gas burners, burning five feet per hour, and 18-candle gas, will give light equal to 72 candles. The same amount of gas, burned in a gas engine, will produce an electric arc light of 2,000-candle power. An average of six different tests made by myself, during the month of June, to ascertain the cost of gas consumed by a 100-horse power Otto gas engine per horse power per hour, resulted as follows: Amount of gas consumed in 10 hours run of gas engine, driving 53 arc lights of 2,000-candle power each, on a $9\frac{1}{2}$ mile circuit, was 10,920 cubic feet, or 1092 cubic feet per hour, or 20.6 cubic feet of gas for each lamp, which at a cost of 50 cents per thousand cubic feet, is $0.0103 per lamp per hour, or per horse power per hour.

Figuring engine, shafting, dynamo, line and lamps, I found that the whole, taken together, represented practically 53-horse power.

In another test where I ran 36 arc lights and 300 incandescents, representing 69-horse power, the consumption of gas was 1,400 cubic feet per hour, or 20.3 cubic feet per horse power per hour, or $0.0115. In a test where I ran 36 arcs and 425 incandescents, representing 80-horse power, the consumption of gas was 1,600 cubic feet per hour, or 20-cubic feet per horse power per hour, or $0.01. These tests show that, as the load increases, the cost per horse power decreases. Following is a report of two 50-horse power Otto gas engines, made in October, 1889, in the state of Wisconsin:

"Facts and figures concerning the month's run of 2 Otto gas engines, 65-horse power, driving 52 arc lights, 2,000-candle power, 11 miles circuit:—October, 1889, total hours, 180 and 55 minutes. Total gas consumption, 264,000 feet. Gas consumption per lamp hour, $23\frac{53}{100}$ cubic feet. During that month 4.84 cubic feet of gas were made from each pound of Youghiogheny coal, thus the coal consumption per lamp hour would be $23\frac{53}{484}=4\frac{8}{10}$ pounds of coal. Cost to produce 264,000 cubic feet of gas consumed in engines, there were required 54,545 pounds, or 27.272 tons of coal at $3.15 equals $85.86. There were obtained from this amount of coal, as by products: Coke, 33 bushels per ton, 899 bushels of 40 pounds; 50 per cent used as fuel, leaves 450 bushels at 10 cents, equals $45; tar, 13 gallons per ton, 351 gallons at 10 cents, $35.10; which leaves the total cost for fuel to drive 52 arc lamps for the entire month of October, $5.76."

There was no extra expense for labor on account of the additional amount of gas produced for the gas engines, nor on account of operating them. The handling of this fuel occasioned no extra-expense. With steam power, not only coal must be handled at special outlay, but also ash. The amount of the fuel, already less than that required by steam power, has its cost materially reduced, and in some cases almost entirely offset by revenues from coke and tar. Where no revenues are obtained from by products, it will still pay to use gas power, 1st, because fuel required per lamp hour is less with gas power than steam power; 2nd, because handling of fuel can be done in gas house without extra expense, but will call for extra labor when consigned to a boiler house.

Following is a quotation from Practical Electricity, Boston: "At the eighteenth Annual Meeting of the New England Association of Gas Engineers, held in Boston, February 15 and 16th, a series of questions were propounded for the consideration of members. One of these questions reads as follows: How will the gas engine work to supply power for an electric light plant? How does it compare in economy with a steam engine?

Mr. A. M. Norton, of Nashua, N. H: "We have a 15 horse-power Otto engine. From the moment we started it the lights burned very steadily, and have all the time. We have ten lights on it. They are the steadiest arc lights that I ever saw. Probably it will not carry ten lights as cheaply as a smaller engine with the same number of lights, but it now runs ten full arc lights, and uses 275 feet of gas per hour, with the lights all on. Mr. C. F. Prichard, of Lynn, Mass:—I have paid considerable attention to the running of the Otto gas engine, in a general way, but not for producing electric light."

It struck me, as Mr. Norton has stated, that the steadiness and reliability of the gas engine for running the electric light lamp has been thoroughly demonstrated. Mr. Norton states that he uses 275 feet of gas to run ten lights an hour. Two hundred and seventy-five feet would be 11 cents per hour. That is it would be 1.1 cents per horse power per hour, assuming it takes one horse power per light. I think it would be difficult to find a steam engine running so small a plant, which would work down to four pounds of coal per horse power per hour, considering the conditions under which they run. Considering the coal that is used to bank the fires to keep them, and the quantity used in starting the fire, I think it is doubtful if the average of the electric light plants will run on less than six pounds of coal per horse power per hour. But, for the sake of comparing with Mr. Norton's figures, let us take four pounds of coal per horse power per hour. Figuring that out at $4.50 per ton, we have the result of one cent per horse power per hour. Mr. Norton figures the gas at 40 cents per thousand, bringing it down to 1.1, which gives us .1 of a cent difference in just this simple case, and we have still to allow for the cost of water for the boiler, and for the labor of firing. The actual expense, as I believe they figure it, is 1.1 cent per hour. In that case then we have the cost identical—whether he runs with the gas engine, and uses gas at first cost, or uses a steam engine with coal at $4.50 per ton. This shows to me that we are able even at the present time with a gas engine to compete with the steam engine for power; it seems to me with increased resources, and the possibility of cheap fuel gas to supply our gas engines, in the future, the steam engine has got to go for running electric light plants.

The discussion, which was continued at some length I will not repeat. It is worth the while of electrical engineers to look carefully into the question of large gas engines Too much attention is being given to small details of electrical construction. It does not matter so much whether a dynamo gives 95 or 96 per cent efficiency, if there is a consumption of 20 pounds of coal per delivered electrical horse-power hour. The brain work spent in securing the the odd 1 per cent in the dynamo would be more profitably invested in studying the behavior of various engines and boilers under the very abnormal conditions that hold in central stations. The question of idle boilers is a serious one. An engine at half load takes too much steam, but it is little good cutting this steam down if the boiler burns almost as much coal when it supplies less steam Central station conditions are about as bad for boilers and engines as they can possibly be. Now consider the case of the gas engine. Allowing that no one but gas companies would think of working electric light stations with coal gas, yet when supplied with water gas or producer gas, the gas engine of to-day can compete with the large steam engines at full load. Under the conditions that prevail in central stations, the gas engine has the advantage, in that when the engine stops, the consumption of fuel stops.

There is no water to boil before starting, and no ashes to remove. Gas engines are less expensive than steam engines and boilers, and can be started and stopped without trouble when wanted. They take less room, make less smoke and are cheaper to run. Large gas engines are being turned out with water gas plants, and with gas producers. The time will probably come when gas engines will displace steam engines altogether in electric lighting stations.

The Otis Feed Water Heater.

For several years special attention has been given to the economical use of steam in power plants and many devices have been invented for utilizing the heat of the exhaust steam which was previously lost. The Otis feed water heater which utilizes the heat of the exhaust steam in heating the feed water has been in general use for a number of years and its efficiency has been clearly demonstrated.

The body or shell of the heater is made of boiler iron or steel, the top of which is riveted to a heavy cast iron ring with a projecting rim on the outside to which the tube sheet and top dividing plate is fastened by one row of bolts. The lower end of the shell is riveted to a heavy cast iron conical bottom which is supported by four legs forming a substantial base for the heater. As shown in the accompanying illustration two sets of tubes run the length of the heater through which the exhaust steam circulates. The steam enters at the top passes down one set of tubes into the large space at the bottom where the water of condensation, oil, etc., is separated. The exhaust steam then passes up the other set of tubes thus passing twice the length of the heater.

The feed water enters the heater at the bottom and comes immediately in contact with the large heating surface of the steam pipes. This surface equals one square foot for each horse power of boiler capacity and with this surface the feed water reaches very nearly if not quite and sometimes above the boiling point before it enters the boiler. In this process the impurities either settle at the bottom or rise as scum at the top where it is collected in a specially devised skimming pan and can be blown off by opening the valve. The feed water is drawn off below the water line so as to avoid carrying any of the impurities from the surface into the boiler.

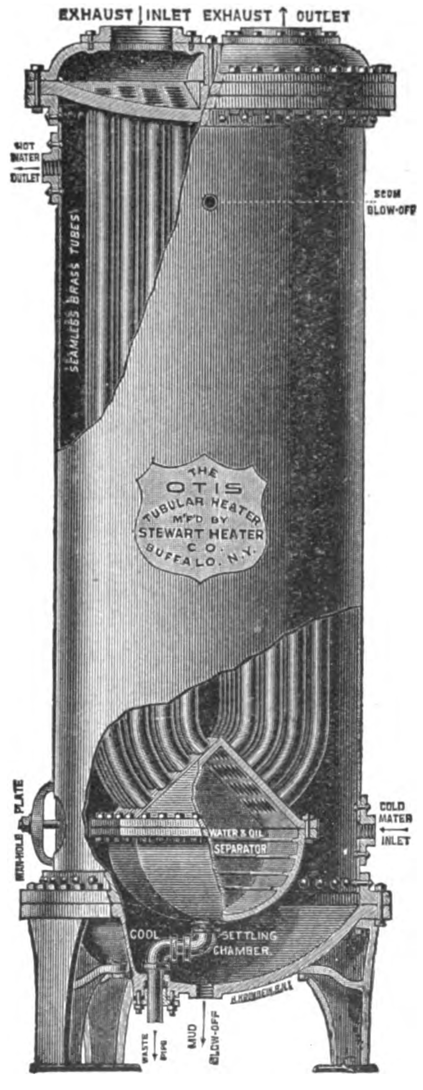
The heater can be thoroughly cleaned in a few minutes; the vertical position of the tubes causes all the impurities from the steam to settle in the chamber at the bottom where they are blown out through the pipe at the bottom. The heavier impurities of the feed water are also removed through a special outlet at the bottom.

The tubes are slightly curved before they enter the settling chamber so that each tube may expand or contract without breaking the connections. The heaters are guaranteed to stand a pressure of 150 pounds, each heater being tested to that pressure before leaving the factory. Heaters are also constructed for higher pressures if desired.

These heaters are manufactured by the Stewart Heater Company, of Norfolk avenue, Buffalo, N. Y.

Belknap Motor Company's Electric Drill.

The entrance of the electric motor into the field of every day usefulness has caused a great revolution in the methods of performing work in all the mechanical arts and has become a necessary factor in the growth of nearly every branch of business; a factor that cannot be overlooked without reaping a great burden of disadvantage. Among the many applications of the electric motor, none appeals to the needs and circumstances of the modern equipped machine shop more perfectly than the subject of the present sketch.

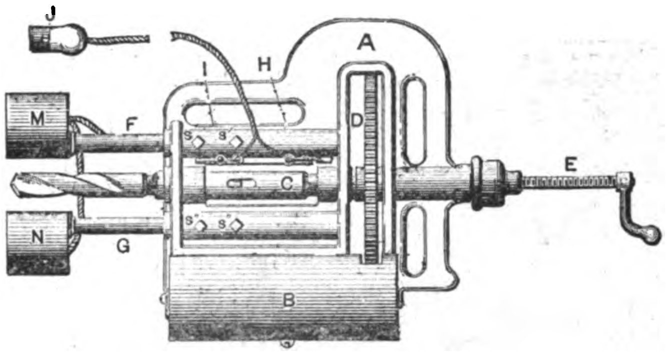


THE OTIS FEED WATER HEATER.

This machine is designed by the Belknap Motor Co., of Portland, Maine, and is being introduced by them to take the place of the old familiar ratchet drill, and to a large extent also to do the work of the upright and of the radical drill, and thus to avoid the old tedious and time-wasting method of dragging a heavy casting across the shop to place it accurately under a fixed machine, and after performing the operation to return it to its former place. The Electric Drill can be carried to any part of the shop as easily as a ratchet drill, and can be applied to any part of the work very much quicker and easier.

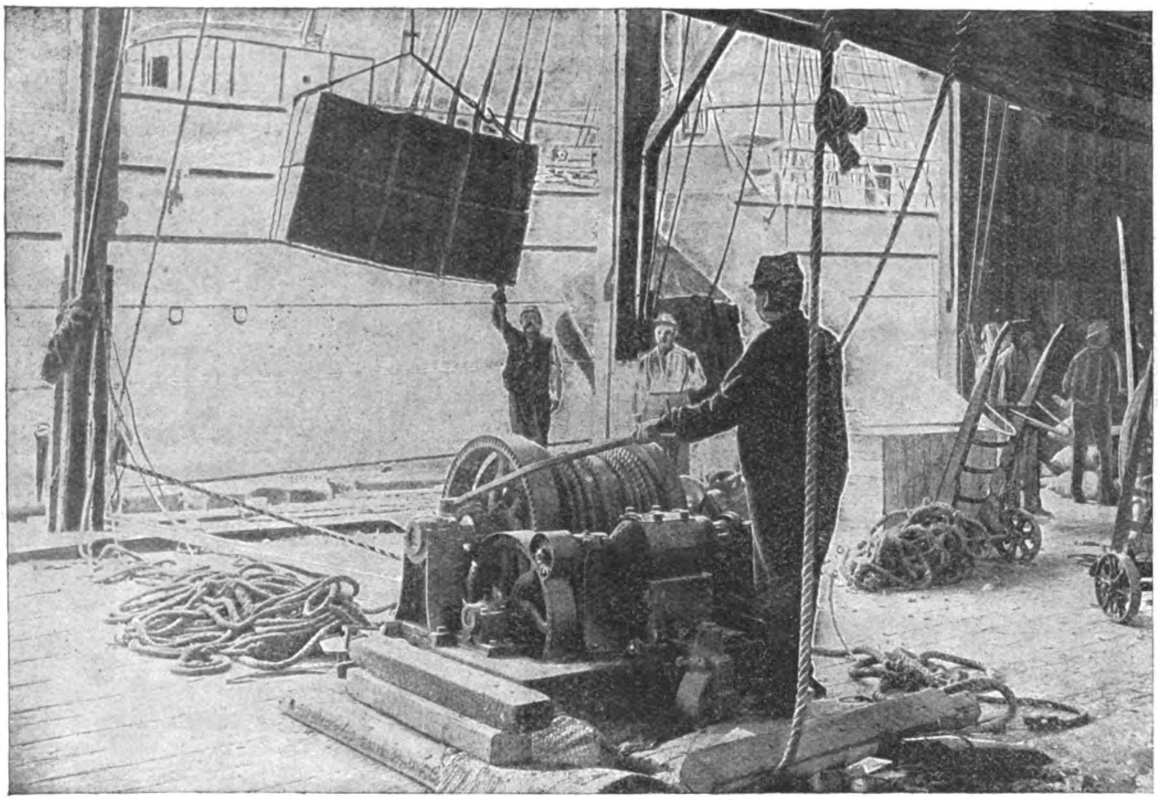
The attachment of the drill to a piece of iron work only requires the turning of a switch. A more detailed description of the drill may be made with reference to the accompanying cut. The framework A is one casting and forms the support for the motor and for all the working parts. The motor is entirely enclosed by the metallic case B.

The spindle C is fitted to receive the taper shank of large drills, and the smaller drills may be used in a chuck. The large gear D receives power from the motor and drives the spindle C by means of a sliding feather and the spindle is moved backward or forward by the feed screw E with handle attached. The frame A has two sockets for the reception of the two stems F G, which may be slid in or out to different positions and secured firmly by set screws S S S S.



THE BELKNAP MOTOR CO'S ELECTRIC DRILL.

M and N are two irod-clad electro magnets attached to the stems F G and are controlled by the switch at H.



THE GENERAL ELECTRIC DOCK HOIST.

The current for operating the motor is controlled by the switch at I. The machine may thus be placed in position and secured before starting the motor, the two operations being entirely independent of each other, although but one cord is used and one plug J for attachment to the nearest lamp socket. The force of the magnets, or suckers, M N is made ample by the proper proportioning of the magnets to the size of drills intended to be used. It is found practicable to require of them a force of 150 pounds per square inch of cross section.

These electric drills are now being manufactured to run on the ordinary 110 volt lightning circuits, by the Belknap Motor Co. of Portland, Maine, U. S. A.

The General Electric Dock Hoist.

The continued use of electric motors in connection with various machines and tools has demonstrated their economy, efficiency and convenience. This fact has been especially evident in the use of electric hoists and machines of like character. Some two years and a half ago electric hoists were introduced on the wharves of Sanderson & Sons, in Brooklyn, where the Wilson transatlantic steamers discharge.

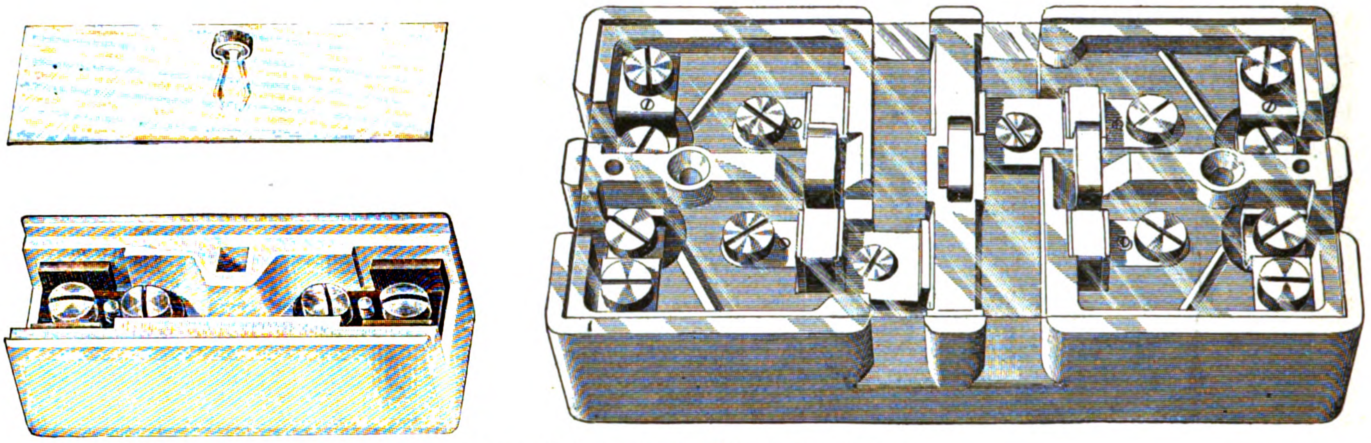
Various opinions were expressed at the time regarding the success of the innovation, but experience has proven the excellent fitness of the electric motor for this kind of work. The installation was made by Messrs. Curtis & Dean, and comprised nine 10-horse power General Electric hoists of the drum and winch head type, the motors being of the bi-polar type. The hoists have been in continual use in loading and unloading of the vessels which arrive and depart from these wharfs.

The ease with which they are operated and controlled and with which they can be moved from place to place has made them favorites with the employees, who, at the time of the installation were greatly prejudiced against them. From an economic standpoint the record of these hoists has been especially good. During the two and a half years in which these hoists have been under continual daily use the cost of repairs has amounted to the small sum of $24.75 or on an average of $2.75 for each hoist.

It may be doubted whether such a record as this has ever been made with a steam hoist. The electric motor in this application as well as in the many others to which it is adapted has been used with the same success in factories, mines, machine shops, and many other places, where economy, rapidity of work, and perfect operation is required.

The New Imperial Cut-Outs.

Among the new appliances recently brought out are the Imperial cut-outs and branch blocks just placed on the market by the Imperial Manufacturing Company of 323 Washington St., New York. They are of an excellent design and contain many improvements in the details of their construction. The accompanying illustration shows the main cut-out and the double branch block. The insulation is entirely of porcelain or mica, and when closed no metal parts are exposed.



FIGS. 1 AND 2.—THE NEW IMPERIAL CUT-OUTS.

All connections are made on the face of the block and every branch taken from the cut-out has its own fuse. All parts of different polarity are carefully insulated from each other and each fuse has its separate compartment. All possible danger of trouble through short circuit in the cut-out is thus avoided. As will be noticed from a glance at the cut, the porcelain base is depressed between the fuse terminals with a ridge in the center that supports the fuse. It is claimed that fuses which touch the base have their carrying capacity largely increased on account of the colder porcelain carrying away the heat of the wire.

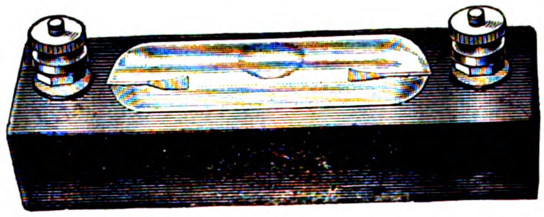


FIG. 4.—THE NEW IMPERIAL CUT-OUTS—POLE INDICATOR.

The construction here employed enables the fuse to operate at its proper fusing point. Each branch of the cut-out is supplied with a double pole plug switch which enables the circuit to be broken, thus allowing the fuses to be inserted without danger to the attendant. It also affords a convenient means of disconnecting any circuit for testing or inspection and also enables the circuit to be cut off at the branch block. The mica covering is conveniently attached permitting its removal without the use of a screw-driver. The company also manufacturers single branch blocks and single pole fixture cut-outs in the construction of which the same principals are employed.

In order to make this line of goods complete the company has recently brought out fuse links manufactured of a special alloy. This metal, while having a low melting point, is sufficiently hard to be used without copper terminals. When extra hard terminals are desired the fuses are furnished with copper plated ends. Another very convenient specialty is the pole indicator which we also illustrate. When using it the negative pole of this instrument as well as the adjacent liquid is quickly colored a bright red which disappears when the indicator is shaken. Two sizes are made, one intended for high resistances, that is, any circuit up to 600 volts, and another for lower resistances. The latter type is very sensitive and may be used to advantage in testing a circuit in place of a magneto.

The New Beacon Lamp.

The new Beacon lamp an outline of which is shown in the accompanying cut is the invention of Wm. E. Nickerson and Edw. E. Carey. The Beacon Vacuum Pump & Electrical Company, Boston, Mass., which has acquired from the inventors the control of the patent rights has just placed the lamp on the market. The construction of the lamp is entirely new, the object of the inventors being to produce a lamp which would in no way infringe existing patents.

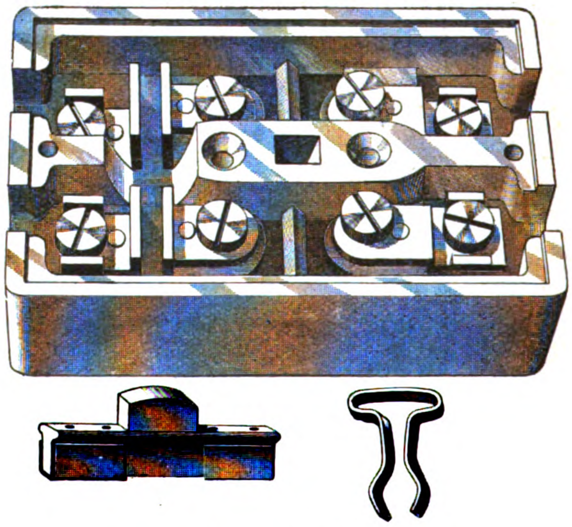
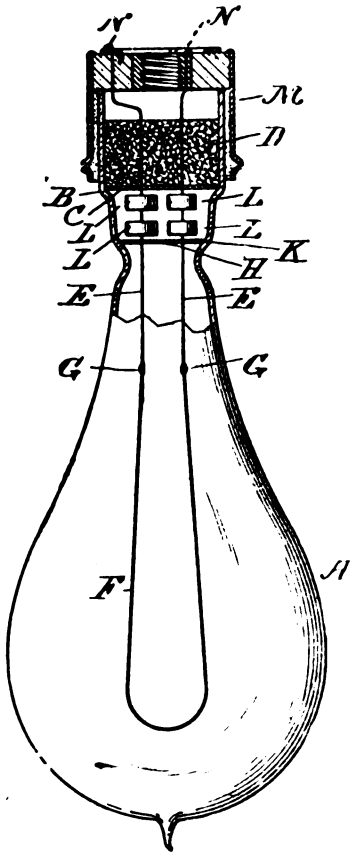


FIG 3.—THE NEW IMPERIAL CUT-OUTS.

As will be seen from the accompanying cut a glass globe A is provided with a shoulder at B, upon which rests a thin disc of mica C. This disc serves as a support for the cement glue, the composition of which is not made public, which is poured in a fused state upon it and which completely fills the upper part of the lamp. An air tight union or joint is made with the glass surface underneath the globe by this cement which is able to withstand the changes of temperature and the action of the air.

The leading in wires E E, which are of iron, pass through this cement and to the mica disc C, but nowhere touch the glass of the enclosing globe, are connected with the filament at G G. A second disc of mica H is located within the neck of the lamp globe and rests upon the shoulder K. The disc H acts as a reflector and throws back the heat of the filament, thereby keeping the cement plug from being effected. Upon the leading in wires between the two mica discs, are placed small bodies of metal L L L L called radiators. They are so called because they take up the heat of the leading in wires and disperse it by radiation. These devices accomplish the purpose in a neat and effective manner.

The neck of the lamp is surmounted by a cap M, of the ordinary kind fastened in place in the usual manner with plaster of paris, to which the leading in wires are attached by soldering at N H. While the lamp is burning the cap and socket are nearly as cool as when it is not in operation and the candle power is maintained in the same manner as in the old Beacon lamp, which was such a favorite and used so largely by the trade. The company have every facility for placing these lamps on the market in large quantities and will give the same attention to the details of construction which made efficient their former lamp.



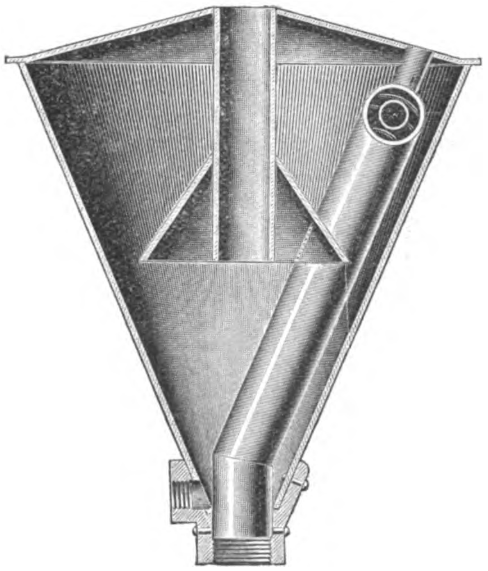
THE NEW BACON LAMP.

The Eclipse Exhaust Pipe Head.

In the accompanying engraving is shown the new Eclipse exhaust pipe head, for which a patent has just been granted to the New York Exhaust & Blow Pipe Co., of Hartford, Conn., by whom these pipe heads are manufactured. The New York office is at No. 156 Liberty street.

The new feature of this head is the manner in which the steam enters the head. As will be seen from the illustration the exhaust steam is carried near the top and then discharged horizontally around the head giving it a centrifugal motion, thus driving all the solid matter to the solid wall, which then runs down the side and out the drip. The light and dry steam is then allowed to escape through the opening in the center of the top.

In addition to the centrifugal motion separating the heavy matter from the light there is a small pipe running from the top outside and so connected that when the exhaust steam is passing through the large pipe it causes a suction in the small one by which the cold air from the outside is drawn into the head. This cold air mixed with the exhaust steam by the centrifugal motion given to the steam, makes a very efficient system of condensing steam. The manufacturers look forward to a prosperous future for these heads which are now meeting with great success. The new ideas involved seem to meet with the approval of steam users.



THE ECLIPSE EXHAUST PIPE HEAD.

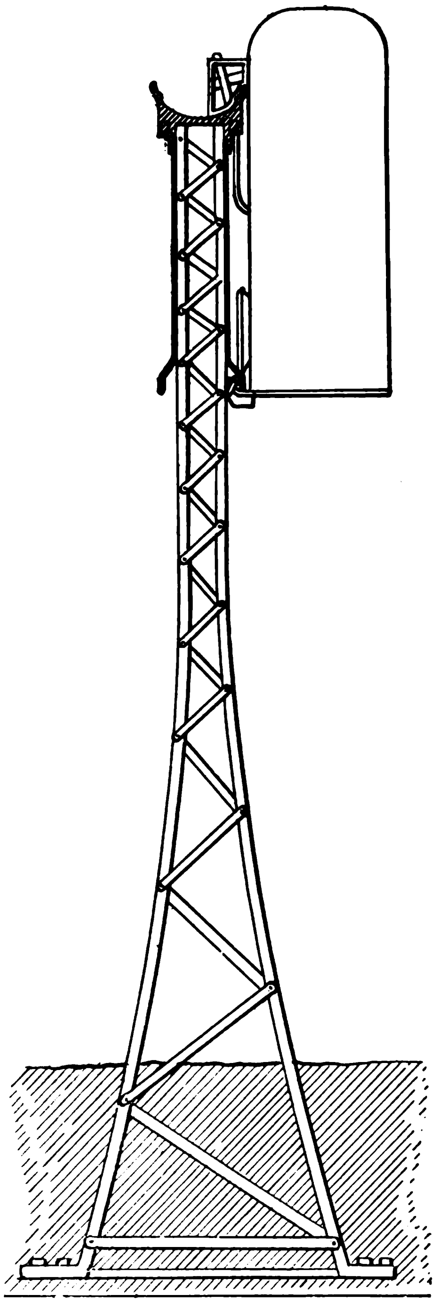
The Cook Elevated Electric Ralway.

Near the Westinghouse Air Brake exhibit in the Transportation Building is a working model of the Cook Elevated Electric Railway. A single row of truss iron pillars, placed from 20 to 50 feet apart and of the desired height, supports the girders, which are constructed in the most approved style of brace work. The top of the girder has an outward and upward flange. The truck runs the entire length of the upper right hand side of the car, the weight resting on two anti-friction wheels placed near either end of the truck, and running on the inside of the flange.

The driving wheel, which is directly connected with the armature shaft and made with bevelled edge, travels on the track at the lower part of the girder, which is made to slope out and down. As the speed increases the driving wheel climbs the track and takes a portion of the load from the truck wheels, which ordinarily support four-fifths of the weight of the car. The driving wheel and the truck wheels are compensating, thus lessening noise and vibration.

A guide wheel runs on the under side of the lower flange and serves the double purpose of preventing the truck from leaving the upper track and of increasing the traction of the driving wheel when desired, being controlled by a lever in the motor room. A shoe brake, also controlled by lever, bears on the outer edge of the lower flange and is wonderfully efficient in conjunction with the under running guide wheel in making quick stops. In practical tests, made last fall at Tacoma on a 800 foot eliptical wooden track, a speed of 42 miles per hour was developed, and stops were made inside of 60 feet while running at this speed, and without inconvenience to the passengers.

The current is applied through a flat copper conductor placed in a perfectly insulated trough on the under side of the upper track, where it is necessarily protected from rain, sleet or snow. A metal brush trolley is used, which will be perfected later so as to allow the car to move in either direction. The motor is of the ordinary street railway type, that used in the Tacoma tests being of the Sperry manufacture. The ground is made by the contact of the driving wheel with its track.



THE COOK ELEVATED ELECTRIC RAILWAY.

Among the claims made for this system by Mr. Cook, who is personally in charge of the exhibit, are the following: A speed of 200 miles per hour; an absence of any jerking or surging motion in starting or stopping; minimum possibility of accidents to passengers or the public generally; low cost of construction; small amount of ground space required for the single line of pillars; one above the other can be constructed on the same line of supports; a modification of the system can be used for express or parcel transportation.

A company has been formed and it is expected that at least two miles of track will be in operation in Chicago before the end of the present year. Such an eminent specialist on the rapid transit problem as Prof. Haupt, of the University of Pennsylvania, unhesitatingly pronounces in favor of the Cook system.

The Newman Non-Interfering Signaling Apparatus.

The Newman Clock & M'f'g Co., of 347 Ogden Avenue, Chicago, is showing samples of its mechanical and electrical watchmen's clocks in the gallery of the Electricity building, section Y at the Exposition. Besides the various styles of clocks and the handsome arrangement of the same in this space, there is another exhibit which forms a very practical part, in the 18 clocks of this company's make placed in various parts of the Electricity Building for the use of the watchmen.

Samples of the mechanical and electrical watchmen detectors in five different styles are shown and a new feature lately added is the Newman non-interfering signaling apparatus, exhibited here as a guest call. Heretofore all such apparatus has been quite complicated and therefore expensive; this one is not so in either case but on the contrary is both simple and inexpensive. The dial instrument fig. 1, replaces the push button in the several rooms of a hotel. A similar dial with pointer is placed in office and as many names of articles or calls may be placed on both as are required. One extra wire is run and may be in series with all the instruments, thus the work of replacing the push button system—with this system is very little. Cuts 3 and 4 show the mechanism for the office and room boxes. When the pointer on the room box is pushed

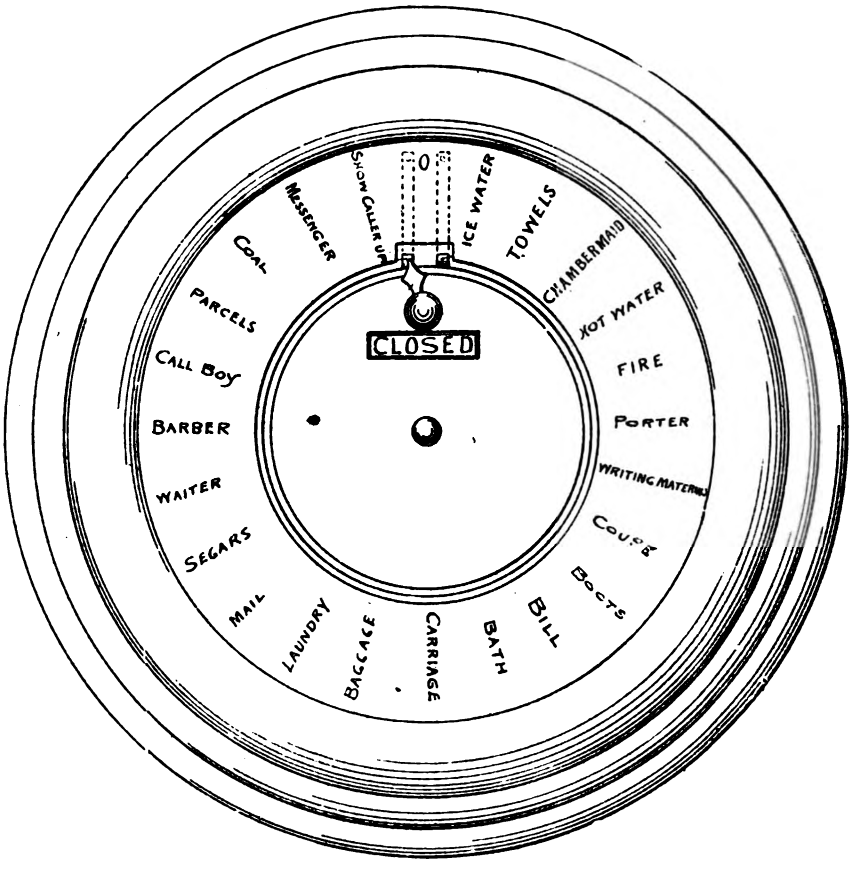


FIG. 1.—NEWMAN NON-INTERFERING SIGNALING APPARATUS.

around to the name of the call wanted, a notice, closed, immediately appears on all dials in the series and no instrument can then be used until the office instrument has been freed by the pressing of the central office button by the clerk, showing that he has given the call his attention. The device is simple, the entire mechanism in either box not being more than that of a plain messenger call box, in fact very similar to it.

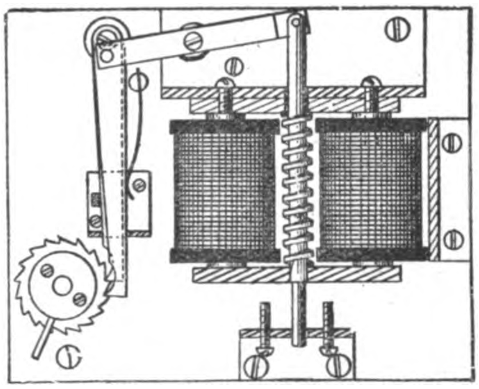


FIG 2.—NEWMAN NON-INTERFERING SIGNALING APPARATUS.

Mr. Newman has so much business in his mechanical clocks that he is forming a stock company to take up the management of the new signaling system. A recent sale of clocks to a customer in Finland indicates the widespread reputation they enjoy.

The Baker Gas Engine.

Joseph Baker & Sons of 58 City Road, London, England have an extensive display of gas and oil engines in the east end of Machinery Hall. Several types are shown, some running with, others without, load; some as regular gas engines and others of the same type with the necessary parts added running as oil engines.

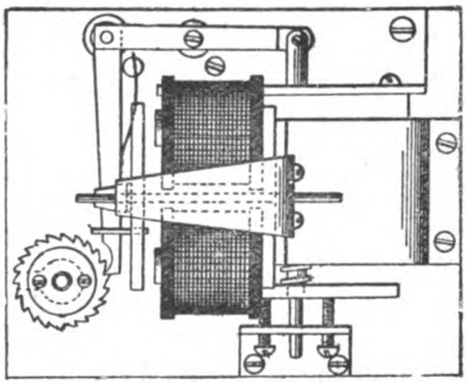
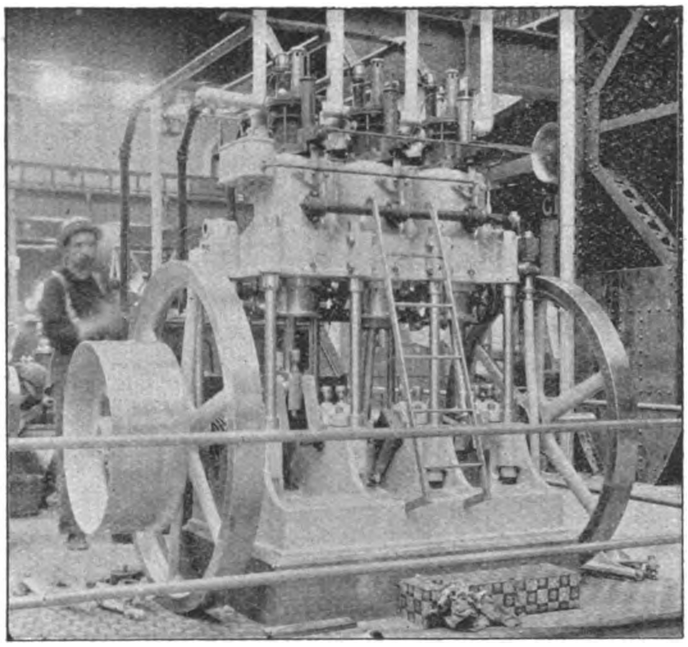


FIG 3 —NEWMAN NON-INTERFERING SIGNALING APPARATUS.

The special claims made for it are, that it can be changed from an oil to a gas engine or vice versa in a very short period of time; will use any commercial oil of flash test between 140 and 300 degrees; is very economical of fuel and can be started in from 7 to 10 minutes. The engine as a gas engine is of the common Otto Cycle type with exhaust and air valves, gas flame, water jacket and pump. To make the same machine an oil engine, there is bolted onto the rear end of the gas cylinder a vaporizing cylinder which being first heated to a proper degree by the flame from a blow lamp vaporizing the oil flowing into it and the heat is maintained by the explosions of the oil in the cylinder. A lamp on the outside is furnished with oil and a wick, the air blast from a pump blowing the flame into the igniting tube where it lights the gas. A double pump on the side of the cylinder actuated by an eccentric on the engine shaft, pumps water to the cylinder jacket and furnishes air to the lamp and cylinder. A very small pump attached to the under side of the vaporizing cylinder and actuated by the same shaft that moves the gas valve levers, pumps oil a few drops at a time into the vaporizer. The supply is controlled by the governor which is remarkably simple.

A crank on the end of the valve shaft moving in a slot in the upper end of a vertical lever that is pivoted below moves the lever back and forward for a space of about two and a half inches. Attached to the end of this lever at its upper end by a pin, is a flat finger about six inches long by three-fourths of an inch wide. On the end of the lever next to where it rests on the pin is an arm extending downward at an angle and sliding on this is a ball of iron which can be fastened at any point on the rod by a set screw.

This weight almost exactly counter-balances that of the flat arm and at slow speed the arm impinges against a notch in the end of the oil pump lever, pushing it forward and pumping a few drops of oil into the vaporizer. In case the speed increases the momentum or inertia of the ball being slow the lever falls and does not catch on the pump rod so no fuel is supplied and the engine slows down. A very slight variation in speed causes the governor to act. Common commercial burning oil is used, a small supply being kept in a tank at the side of the engine and conducted by very small copper pipes to the pumps.



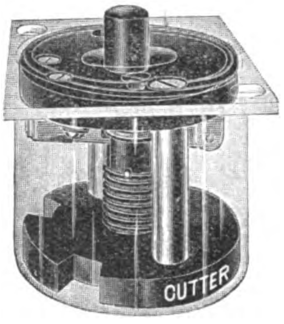
THE BAKER GAS ENGINE.

The amount of fuel required per horse-power per hour is said to be about one half pint. The cut herewith shows the three cylinder vertical oil engine displayed in the front part of the exhibit. The cranks are set at 120 degrees from each other to provide smooth running, and each cylinder is a complete engine in itself, being provided with running gear so that any one or two or all engines may be run at once. About the only difference is the change of governor to meet different conditions. A special feature on the machine not often seen in this country, is the style of gear used to run a shaft at right angles to the main or crank shaft; the gears have diagonal teeth cut in their peripheries and mesh at right angles, one acting as an exaggerated worm.

The application of oil engines seems to have been quite extensive both in England and on the continent and it would seem as if they might be nsed to advantage in this country if once properly introduced. It is probable that with gas at present prices the gas engines will not be universally used, but with the large supply of oil, the oil engine could be used economically.

Cutter's Economic Door Switch.

Among the most novel devices which are on exhibition at the electricity building are some which George Cutter has been developing, and which are only now ready for the market. One of these is a switch for controlling the current by the opening and closing of a door, so as to keep the cost of the lighting at a minimum. Most housekeepers know how expensive it is to light closets, store rooms and the like as the hired help will persist in burning the lamps continuously. Such a waste of current is easily avoided by setting an economic door switch into the rabbit of the door jam, so that the door itself will operate the switch. Then the light will burn only so long as the door is open, and the saving in current and in the life of lamps will soon pay for the controlling device.



Our cut shows the general appearance of this new switch which has a spring action, is well built and carefully insulated. Having a cylindrical casing, it is very easy to fit to the woodwork, no expert being required. Other uses for this switch will soon suggest itself, and it looks as if Mr. Cutter ought to find a wide market for it.

Convention of the Canadian Electrical Association.

The third convention of the Canadian Electrical Association is to be held at Toronto on September 12, 13 and 14. The following program has been arranged:

Tuesday, Sept. 12, 2 p.m.

President's Address and General Business.

Paper by Mr. Fred. C. Robertson, Toronto. Subject: "Some of the Causes of Interruption to Telegraph Circuits."

Paper by Mr. A. C. McCallum, of Peterboro. Subject: "Water Wheels."

Wednesday, Sept. 13, 10 a.m.

Nomination and Election of Officers, and selection of place of next meeting.

Paper by Mr. L. B. McFarlane, of Montreal. Subject: "The History of the Telephone in Canada."

Paper by Mr. E. B. Merrill, Toronto. Subject: "Electrical Education."

Paper by Mr. John Langton, Toronto. Subject: "Direct Connected Dynamos and Steam Engines."

Paper by Mr. E. Carl Breithaupt, of Berlin, Ont. Subject: "Electric Street Railways."

On Thursday a pleasure trip has been arranged, which includes a ride by steamer to Queenstown. A trip by special cars, placed at the disposal of the party, through the courtesy of Mr. W. A. Grant, manager of the Niagara Falls Park & River Electric Railway, to Chippewa; an inspection of the power house of the road; also, by invitation of Capt. Carter, the members will visit the falls at Table Rock and Prospect Park, the works in the tunnel district. The party will return by boat.

Banquet to the Foreign Delegates.

The event of last week socially was the banquet given by the American electricians to the foreign delegates to the international congress on Thursday evening at the Grand Pacific hotel. In parlor 44 there were gathered the foremost electrical scientists of the world. Dr. Von Helmholtz of Berlin, upon whom all looked as one of the fathers of the science, and Thos. A. Edison, the great American inventor, divided the honors of the evening. The toastmaker, Prof. Elisha Gray, occupied the center chair at the table of honor. At his right sat Dr. Von Helmholtz, Prof. Rowland, Dr. Mascart, Prof. Carhart, Dr. Budde, Prof. Nichols, Dr. Violle, Prof. Houston, Prof. Thompson, Mr. Lockwood, Prof. Dolbear, Prof. Brown-Ayres, Dr. Tourrane, Dr. Lummer, Mr. Wenmann and Dr. Sahulka, while on his left sat W. H. Preece, F. R. S., Dr. Mendenhall Prof. Farraris, Prof. Thomson, Prof. Ayrton, Prof. Cross, Dr. Shrader, Prof. Crocker, Dr. Palaz, Prof. Thomas, M. Hospitalier, Dr. Voit, M. Chavez, and Messrs. Wetzler, Pope, and Phelps. At the table directly opposite Prof. Gray sat Mr. Thos. A. Edison with Messrs. Emery, Wheeler, Insull, and Kennelly. The following is the menu served:

MENU.
Little Neck Clams
Consomme Royal
Fresh Penobscot Salmon, Hollandaise
Dressed Cucumbers
Chateau Lauterne
Fillet of Beef, Larded, Financiere
Browned Potatoes New Lima Beans
Mumm's Extra Dry
Sweetbreads in Cases
French Peas
Siberian Punch
Breast of Young Chicken with Truffles
Tomato Mayonnaise
Pontel Canet
Peaches and Cream
Charlotte Glace Fancy Cake
Roquefort Coffee

At 8:30 Prof. Gray arose and presented the first toast, "The International Electrical Congress," and called on Dr. Von. Helmholz to respond, who said, "We Europeans have come over here with the feeling of a good father rejoicing in the success of his children, to which he himself could not attain. Europe is too narrow for the splendid march of electrical progress and America has grandly performed the task set before it. We see in you the result of better conditions and prospects than we have enjoyed, and we rejoice with you in your remarkable advancement. Gentlemen, I drink my glass to the great American Nation." Prof. Gray then proposed "Our Guests, the Official Foreign Delegates," to which Mr. W. H. Preece, Prof. E. Mascart and Prof. Ferraris responded. Prof. W. E. Ayrton of London responded to "The American Electrical Engineers", and Prof. E. J. Houston to "The American Institute of Electrical Engineers." The other speakers were Prof. S. P. Thompson, Dr. Mendenhall, T. D. Lockwood, Prof. H. A. Rowland and Prof. Elihu Thomson.

A very interesting type of engine is that shown by the Dake Engine Manufacturing Company, of Grand Haven, Mich., in Column G, 1-37, Machinery Hall annex. It is exceedingly simple in construction, having but two moving parts outside of the crank itself, and consists of a thin, oblong rectangular box containing the piston. The piston is double, the outside part sliding from end to end of the box; the other part, being inside the first, slides up and down in a direction at right angles to that of the first. Steam is admitted through ports cast in the casing to the center of the shell and exhausts through a circular port surrounding the central admission port. Owing to the double piston and double action, there are no dead points and the engine will start from any part of the stroke. It is said that the engine may be run at any speed up to a thousand revolutions per minute.

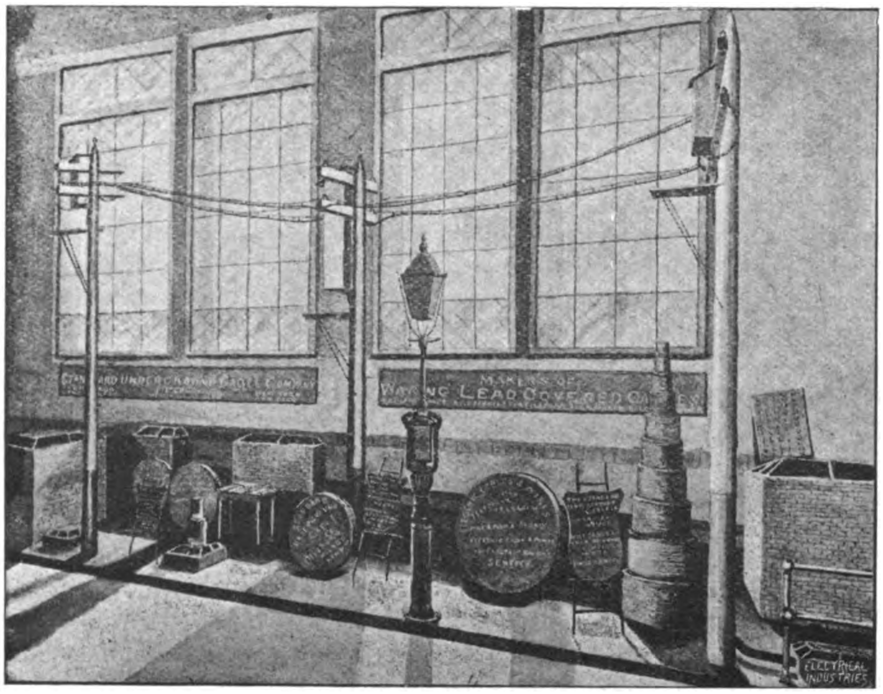
Exhibit of the Standard Underground Cable Company.

Just west of the exhibit of the Sperry company in the south-western part of Electricity Building on the main floor the Standard Underground Cable Company has placed its exhibit. As a background to the exhibit there has been erected a representation of an elevation of a street showing the pavement on top, the soil beneath and the position and method of laying the Standard Underground system.

The conduit is shown as it actually appears in the ground. Manholes are constructed in the line of different kinds and through the open side the interior is exposed to the view of the visitor. The lead covered cable is there shown with the joints and branches, made according to the methods adopted by the company. The manholes are covered with frames and covers of the latest pattern. All details have been so faithfully carried out that the visitor almost believes himself in a trench in the street. There has also been erected in this space a pole line showing the Standard company's overhead system. Several poles have been placed at convenient distances apart for displaying the system. From these poles are strung a line of duplex cable supported on hangers from an iron wire. The poles are low enough so that every detail is in plain view of the visitor.

A special feature of the exhibit is the presentation of the various means of terminating the cables in appliances known as terminals, whereby the end of the cable is hermetically sealed and yet presenting an easy and effective method of reaching the ends of the wires for tests or connections. Under this head are shown the distributing boxes by means of which a main cable may be cut into, the wires for various services may be taken out without disturbing the working abilty of other lines in the cable. This is practically shown in the taking from the manhole and up the pole a section of underground cable and connected through a terminal to the aerial cable for distribution above ground. On a table near the center of the space are exhibited numerous sections of lead covered cables which the method of making different kinds of joints. Main line joints, branch connections, etc., in electric light and power cables, in telephone, messenger and other cables are shown.

Near by is a pile of cases containing the ozite compound extensively used as an insulation for filling cable joints, cable terminals, splice boxes, converters, etc. Variously distributed about the space are reels, showing the kinds and character of wires and cables manufactured by this company. The line includes wire for every branch of the electrical industry. In pyramid form are arranged reels of wire and cables with the large lead covered messenger and telephone cable at the bottom, above which are placed smaller cables and wires, both braided and waterproof, then the smaller wires, lamp cord and annunciator wires. Several large reels of the lead covered duplex cable specially adapted for the alternating current are shown, also cables for high tension light and power circuits, and numerous samples of the Waring anti-induction cables of the flat and clover leaf styles. A complete set of tools is also shown for removing the lead casing and the insulation from the wires, showing the perfection of this branch of the work and the facilities for performing quickly and easily any alterations.


STANDARD UNDERGROUND CABLE CO.
MAKERS OF WARING LEAD COVERED CABLE
ELECTRICAL INDUSTRIES

THE EXHIBIT OF THE STANDARD UNDERGROUND CABLE COMPANY.

While the exhibit shows in a general way the range of the business of the company an inspection of the lighting and power distributing system of the Exposition will show the capabilities of the company for complete and extensive installations. Within the grounds of the Exposition 390,000 feet of feeders and mains used in the distribution of the alternating current for the incandescent lighting of the grounds and buildings have been installed and maintained by the Standard Underground Cable Company.

A BRIEF REVIEW.

The use of electricity in hospitals for registering the temperature of patients is thus described in a recent number of World's Progress: "Of the many lately devised applications of electricity to the registration of temperature, one of the most ingenious is that proposed for use in hospitals, whereby the temperature of the patient can be constantly brought to the cognizance of the attendant or physician. It is well known that in certain diseases, especially in rheumatic fever, the discovery of a sudden increase in temperature is of the utmost importance. That this can be instantly recorded, it is only necessary to fix a bulb under the arm of the patient and the sudden increase in the body heat will be announced at once by the ringing of a bell. If this application be further developed, it seems probable that every patient in the ward will wear the apparatus fastened under the arm-pits, each bulb being connected with the number indicated to the house surgeon's room, so that the dresser or house physician will only have to lift up his eye and read on the indicator the intelligence that number three or four in such and such a ward has developed an alarming degree of temperature. This invention is very much akin to that of M. Tavernier, who has devised an apparatus for registering a rise of temperature through friction in any part of the machine. The apparatus consists of a small metallic bulb half filled with ether, the bulb being hermetically sealed with a corrugated cover; any elevation of temperature in the medium in which the bulb is placed causes, through the expansion of the ether vapor, a straightening out of the cover which is thus made to complete an electric circuit and sound an alarm bell."

In a recent number of the Electrical Engineer a plant installed for the production of ozone on a commercial scale is thus described: "An interesting plant for the production of ozone on a commercial scale, the invention of M. E. Andreoli, is now in operation at the works of Messrs. Allen and Hanbury, Bethnal Green, E. London. The apparatus used is electrical, the ozonizer consisting of a number of serrated strips formed up into grids, and separated from each other by plates of glass. On connecting these grids with opposite terminals of high potential alternating currents, a brush discharge takes place on to the glass from the points of the serrations, and the characteristic smell of ozone is quickly apparent. In practice, where a large quantity of ozone is required, a number of these plates are arranged together in a suitable case, and the discharge having been established, a current of air is sent through the case, whence it issues in a highly ozonized state. To insure the purity of the air used, it is filtered through a cotton filter, and cooled and dried before it is passed into the ozonizer. The electric current is supplied by a one-horse power alternator working at 100 volts, which has been supplied by Messrs. Pyke and Harris. The current obtained from this machine is then transformed up to 10,000 volts by means of a Swinburne transformer, this being the potential used in the ozonizer. It is proposed, amongst other uses for the apparatus, to supply it for ageing wines, beers and spirits. It is claimed that in a few hours, by the use of the ozonizer, raw spirits or new wines may have the same mellowness, flavor and bouquet imparted to them as if they had been kept in the cellar for years. Another suggested employment for the ozonizer is the preparation of oils for painting, the same result as to drying properties being obtained as by boiling the oil, but combined with a great improvement in its clearness and color. The oils, in fact, are bleached in the process. A further claim is made for the use of ozone in bleaching paper pulp. In combination with chlorine it is asserted that paper pulp can be bleached at from one-half to five-eighths its usual cost."

The recent installation of an electrical disinfecting plant at Brewster, New York, gives evidence of a new field for the use of the electric current. The Electrical Engineer recently described this plant which contains one 15-horse power engine coupled to a Zucker & Levitt dynamo with a capacity of 700 amperes at five volts. Near the dynamo is an electrolyzing tank with a capacity of 1,000 gallons, in the bottom of which are placed three copper plates plated with platinum alternating with four carbon plates. This tank is fed from a larger tank and the supply is so regulated that the water is electrolyzed and overflows into the sewer.

As a result of the threatened invasion of cholera, examinations were made of New York's water supply, and it was found that the sewerage from Brewster which drained into a marsh situated on an elevation, percolated through the soil and finally reached one of the streams forming the awter supply of New York. As these marshes were also a a nuisance to the health of the citizens of Brewster, the authorities of both places were interested in means for relief.

The ordinary methods employed for the purification of sewerage and the destruction of the germs to which cholera is due, and by which it is disseminated in drinking water, involve the use of chemicals containing hypochlorites and chlorides more or less expensive. Dr. Edson was led by the great difference in cost and other advantages to adopt the system proposed by Mr. Albert E. Woolf.

The chlorides, bromides, etc., in sea water are converted by the passage of the electric current into hypochlorites, hypobromites and various other compounds. When a solution of hypochlorite of sodium is brought into contact with organic matter decomposition takes place and if the solution is strong enough the matter is completely disinfected.

The use of this system at Brewster is said to be entirely satisfactory. The offensive odors are absent from the marshes and the green algae and other vegetable matter have become bleached since this plant has been operated. Tests of the Woolf disinfectant show that it equals in strength a one per cent solution of chloride of lime. A one per cent solution of chloride of lime costs about 1.4 cents per gallon with lime at six cents per pound, while the estimated cost of the electrolyzed sea water is only 10 cents per 1,000 gallons. The electrolyzed sea water is harmless, while many of the chemical disinfectants are harmful in the hands of inexperienced parties.

The important part that the telephone will play in the battle fields of the future is thus commented on by Second Lieutenant George O. Squier, who says: "Some recent experiments abroad by Captain Charollois on the use of a field telephone outfit for military operations indicate that it has great possibilities as a means of communication in the field. Capitain Charollois uses a bi-metallic wire, with steel core surrounded by copper. Thus it is not easily oxidized, and has great strength for a given cross section. This wire is unwound naked upon the surface of the ground, the earth return being complete through the operator himself, or his horse in case he is mounted. The small magnetic receivers can be used as the wire is being paid out on the ground, and this constant communication is kept with the starting point as the line progresses. By the use of such small wire the entire material for a line of one mile weighs less than five and a half pounds. Each reel carries 10,000 feet of wire, and is conveniently and compactly strapped to the soldier as a part of his equipment. On account of the extremely minute currents required in telephony, the only limit to the smallness of the wire, and its consequent weight for a given length, is the fear of breaking while it is being laid. Cavalrymen, or infantry on bicycles, could establish a line with great rapidity. In some recent experiments in the field, a 14 mile line was completed in five hours and taken up in one hour; and the passage of a division of cavalry over the wire did not interrupt the communication of a dispatch that was being sent at the same moment. No batteries are required; no poles of any kind; no heavy cumbersome wire to be strung, and any one can operate.

"In view of the above, and that we are now talking between New York and Milwaukee, there is but little doubt that the telephone is the instrument both for the field and for permanent lines.

"The writing telegraph, when perfected, will undoubtedly have its important *role*, as by its use maps, plans of battles and fortifications, and drawings of all kinds can be reproduced with accuracy at any distance."

World's Progress thus speaks of the origin of electric lighting: "It is curious, but wonderfully true, that no sooner does an inventor make a success in a new direction, steamboat, harvester, anæsthetic, electric motor, or what not, than presently some other party comes forward to prove incontestably that he had long before practically developed the same idea.

"It now appears that claim is made that the great Franklin had fully reduced the electric light to perfection considerably more than a hundred years ago. This does not rest in assertion, but the Franklin lamp is produced! It is in a good state of preservation, and has recently been tested by the owner, a gentleman residing near London, who finds that it works as satisfactorily now as when Franklin himself experimented with it. It is a curiosity of great value and importance in illustrating the history of electric lighting. It is by no means the arc light or the incandescent lamp of modern times. Its principle, however, is that of the arc light without carbon points; this device, which was invented by Sir Humphrey Davy in 1813, first demonstrating the practicability of electric lighting. The total length of the cylinder, within which the light is produced, is about 12 inches and the diameter three inches. Each end is provided with attachments for connecting it with the positive and negative poles of the machine, which, it should be remembered, was the only means of generating electricity with which men were then familiar.

The electric light in this rude but ingenious device was produced by the leaping of the intercepted current from the ball to the metallic point. The ends of the tube are partly closed, undoubtedly for the same reason that the globes of the arc light are closed at present, and the light given off is brilliant and steady.

The machine with which Franklin generated the electricity for this novel experiment is turned by a crank, grindstone like, and was the most powerful and complete in construction of any electrical machine of that day. This crank turns a ponderous cylinder of glass, which is rubbed by brushes with silk covers. These brushes convey the electricity collected from the cylinder to the positive and negative conductors, supported on large glass pillars, where it can be used for purposes of experiment. The machine is stanchly built, and is capable of producing a spark twelve or fifteen inches long. While simple in its construction, it could hardly be improved upon by our wisest electricians. It is especially adapted for the advanced experiments of various kinds which Franklin was engaged with at that period of his life.

The importance of practical experience in the training of electrical engineers is emphasized by Prof. S. P. Thompson in a letter to the editor of Electrical Plant and Industry, London, in which he says: "The education of a student of electrical engineering, whether liberal or illiberal, must be an education obtained from things and men, in the laboratory, the workshop, and the drawing-office, can be aided by books and lectures; but these do not and cannot constitute the education of an electrical engineer. From that point of view there is more educational value in a half-yearly volumn of one of the weekly technical journals than in a ton of text-books. Give the student of electrical engineering the run of a laboratory well equipped with modern electrical machinery and instruments, and a good library of books of reference, and bring him into daily contact with men who are themselves both electricians and engineers, he will want few books beyond his own note-books and a pocket-book of numerical data. It is a real disaster to the electrical industry, and to the thousands of young men who are just now swarming into it on all sides, that the idea should prevail that so essentially practical a subject can be crammed up by mastering a certain list of books. It is mainly because we are convinced of the evil wrought by such misinformed ideas that Mr. Knapp and I, who have now for two years been colleagues as examiners in this subject in the City and Guilds Technological examinations, have determined to set such questions as shall be impossible to be satisfactorily answered by the mere paper electrician, whilst they shall be comparatively easy to answer by the candidate who has really mastered his subject by becoming practically acquainted with it in the laboratory, the drawing-office, and the workshop, the lighting station, or the testing-room. Electrical engineering can no more be learned from books than can railway engineering, or hydraulic engineering, or any other branch of the great electrical industry.

With the exception of a few minor improvements in the arc lamp mechanism, looking towards the steadying of the arc, there has practically been no change or advance in the art since its first practical exploitation some fifteen years ago. The frequent renewal of the carbons, though early recognized as the most serious drawback in this otherwise unsurpassed method of illumination, is still a necessity, notwithstanding the many attempts which have been made to overcome this disadvantage. It would seem, however, that we are now placed in possession of a method which is deserving of the most serious consideration by all interested in arc lighting, and the paper read by Mr. L. B. Marks before the Electrical Congress contains a large amount of data on the new device. Perhaps the principal merit of the plan outlined by Mr. Marks is to be found in its simplicity and its ready applicability to existing arc lamps, for it is safe to say that it would require more than ordinary superiority in any apparatus to warrant its introduction to the discarding of older, well-tried mechanism. In this respect, therefore, nothing seems to stand in the way of its introduction. The reduced expense in trimming arc lamps, let alone the saving in cost of carbons, which would be effected by a lamp burning continuously for one hundred hours, must appeal to every central station manager. There is also another aspect to the question which was not touched on in the discussion of Mr. Marks' paper before the Congress, and that is the probable increase in interior arc lighting which will follow the introduction of a successful 100-hour arc lamp. Already arc lamps of 100 to 200-candle power have come into use to quite an extent abroad, especially in Germany, and it is not difficult to discern the extent to which the arc lamp of small candle power, using scarcely more than two or three amperes can be applied, once its practicability is demonstrated in connection with a device which will require no attention to be given to the lamp for a week or two at a time. We hope that a trial on a practical commercial scale of the new Howard device will be made at an early date. Its importance to the future of the electric lighting industry cannot be overestimated.—Electrical Engineer.

FINANCIAL.

Confidence is gradually returning to the country, although slowly, yet sufficient to show itself in the prices of several of the staple commodities.

During the past month a number of banks have resumed, the number of failures has decreased, and many of the large factories and mills are preparing to resume.

Before the country fully recovers a reorganization will have taken place and a different scale of prices established. Raw materials of all kinds are sold at the lowest prices known. Stocks and bonds have greatly declined, but a more hopeful feeling prevails notwithstanding the tardy movements of congress.

The house of representatives has at last reached a decision on the silver purchase act, but whether congress will accomplish anything in the near future for the relief of the situation is extremely doubtful.

Among the electric companies the street railway companies feel the situation least. The large manufacturing companies are reducing expenses and are proceeding in a very conservative manner. In regard to the management of the General Company, concerning which many reports have been circulated, the United States Investor says:

"The probabilities are that we shall see a new president and new officers for this company in a very short time. It has leaked out that the rumors that have been current at various times of dissension and strife inside the company are only too true; and many people who are well acquainted with the inside workings of the General Electric Company state that these troubles have helped to bring the company to its present doubtful condition more than anything else. No doubt there is considerable truth in this; without a doubt the disagreements between the various factions cannot have helped the company in any manner whatever.

"Present appearances denote that the financiers of the late Edison Company have got the best of the struggle. At the present time of writing they are undoubtedly in the supremacy. The practical abolishment of the Boston offices, or, we might say, their removal to New York, was seemingly the confirming step. Already there is considerable talk inside the company of the steps that the new management will be likely to take. Men who held prominent positions under the Thomson-Houston management are feeling despondent; those who held positions under the Edison Electric Company are feeling jubilant.

"The question of patents will naturally come up in the minds of the readers of this article. Undoubtedly the General Electric Company possess many valuable patents, but to those who are acquainted with the quick advancement of the electrical industry these holdings do not seem much of a bugbear. It has become of late the practice of many of the electrical companies not to take out patents, because the rapidity with which new discoveries are made often antiquate them before the slowness of the patent office departments grants them. This is noticeably the case in street railway work, which makes the bulk of the electrical business. No sooner is one motor got into working order and on the market than another having radical changes and great improvements is invented.

"What applies to this branch of the electrical industry applies to all the others. The General Electrical Company has lost immense amounts of money in litigation, the most noticeable case being that of the incandescent lamp. True enough, they succeeded in stopping a few concerns from manufacturing lamps, but only for a short time. There are now three lamps that do not infringe, and, what is more, are being manufactured, the last one to come out being the 'Beacon lamp.' It will be remembered that only a short time has elapsed since the General Electric Company succeeded in closing this concern up. They are now out with a new lamp, and are offering to let other manufacturers manufacture them at a royalty, which allows them to sell at much cheaper rates than the General Electric Company are selling theirs at.

"The Westinghouse Electric Manufacturing Company brought out a new lamp some months ago, which they are manufacturing at low rates without any fear of an injunction. We may state further in regard to the patent difficulties that a new electrical company would experience that the whole of the electrical industry will be completely revolutionized during the next few years by the discoveries that are being made and projected. Therefore it is safe to state that should the old managers of the Thomson-Houston Company withdraw from the General Electric Company they would experience no difficulty in regard to patents; they would have as large a field as they ever had, and there is no doubt but that with the talent they would take with them and the prestige of the old Thomson-Houston Company they would succeed in downing the General Electric Company."

NAME OF COMPANY.	DESCRIPTION OF SECURITY.	AMOUNT ISSUED.	PAR VALUE.	RATE INT.	DATE PAYABLE.	CLOSING July 29
Miscellaneous Securities.						
American Bell Telephone Co....	Stock.	$17,500,000	100	....	J. Q.	175
" " "	Bds. 1898.	2,000,000	100	7	F. & A.	106
American Tel. & Cable Co... ...	Com.	14,000,000	100	....	....	77
Commercial Cable Co	Com.	7,716,000	100	....	....	100
Edison Elec. Ill. Co., Boston....	Com.	2,025,800	100	....	F. Q.	130
" " " ...	C. Bds. 1898.	71,000	100	6	M. & S.	.....
" " "	C. Bds. 1901.	586,500	100	6	M. & N.	.....
" " Brooklyn..	Com.	2,500,000	100	....	Q. F.	85
" " " ..	1st. 1940.	500,000	100	5	A. & O.	.....
" " " ..	Regis.	....	100	5	A. & O.	.....
" " Chicago...	Com.	3,000,000	....	8	Q. F.	.....
" " "		2,500,000	....	....	....	.....
" " New York.	Com.	7,938,000	100	....	Q. F.	97
" " "	1st 1910.	2,562,000	100	5	M. & S.	.....
" " Phila......	Com.	1,473,000	100	....	....	120
" " "		....	....	5	....	.....
Fort Wayne Elec. Co...... ...	Com.	4,000,000	25	....	....	4½
General Electric Company.	Com.	30,457,000	100	....	......	39
" "	Prf'd.	4,251,900	100	....	....	58
" "	Deb. 1922.	10,000,000	100	5	J.-D.	65
Gold & Stock Tel. Co............	Com.	5,000,000	100	....	Q. J.	.....
Northwestern Gen. Elec. Co....	Com.	1,000,000	100	....	....	.....
" " "	Prf'd.	750,000	100	....	J. Q.	.....
Thomson Elec. Welding Co......	Com.	1,000,000	100	....	....	.....
Thomson European Welding Co.	Com.	1,500,000	100	...	....	.....
Thomson-Houston Elec. Co ..	Series D.	120,000	10	....	....	.....
Thom'n-Houst'n Intern. Elec. Co.	Com.	600,000	100	..	....	.....
" " " "	Prf'd.	400,000	100	....	....	.....
United Electric Securities Co....	Com.	1,000,000	100	....	....	.....
" " "	Prf'd.	1,000,000	100	....	F. & A.	....
Western Union Tel. Co..........	Com.	94,820,000	100	....	Q J.	78¾
" "	Var. Issues	13,088,000	100	7&5	M. & N.	.....
West'gh'se Elec. & Mfg. Co	Ass'ting.	5,333,940	50	....	....	18
" " "	1st Pf. Cum.	3,755,700	50	7	....	38
Electric Railway Securities.		*				
BROOKLYN—						
Brooklyn City R. R..............	Com.	6,000,000	10	....	Q.-J.	170
" "	1st Bds. 1916.	3,000,000	100	5	J. & J.	90
Coney Island & Brooklyn R. R..	Com.	500,000	100	....	Oct. 1.	.....
" " " ..	1st Bds. 1909	300,000	100	5	J. & J.	.....
" " " ..	Certf. 1894.	300,000	100	6	J. & J.	.....
BUFFALO—						
Buffalo St. Railway..............	Com.	5,370,500	100	5	....	.....
" "	Bds. 1931.	5,000,000	100	....	F. & A.	.....
BOSTON—						
West End St. Railway..........	Com.	9,085,000	50	..	J. & J.	54
" "	Prf'd.	6,400,000	50	5	J. & J.	76⅛
" "	Bds. 1902.	3,000,000	100	....	M. & N.	.....
LOUISVILLE—						
Louisville St. Railway Co........	Com.	5,000,000	100	....	....	.....
" "	Prf'd.	1,000,000	100	5	A. & O.	.....
" "	1st Bds. 1930	6,000,000	100	....	J. & J.	.....
NEWARK, N. J.—						
Newark Passenger Railway......	Com.	6,000,000	100	....	....	27⅜
" "	Bds. 1930.	6,000,000	100	5	J. & J.	84⅛
NEW YORK—						
Union Railway Co...	Com.	2,000,000	100	....	....	155
" "	Bds.	2,000,000	100	...	....	.....
PITTSBURGH—						
Duquesne Traction Co........ ...	Com.	3,000,000	50	...	....	22
" "	Bds. 1930.	1,500,000	100	5	J. & J.	100
Fed. St. & Pleas. Val. R. R.......	Com.	1,400,000	50	....	J. & J.	20
" " " " "	Bds. 1919.	1,250,000	100	5	J. & J.	100
Pittsb'gh, Aleg. & Man. R. R.....	Com.	3,000,000	50	....		42
" " "	Bds. 1931.	1,500,000	100	5	J. & J.	99½
Pittsburgh & Birming. R. R.....	Com.	3,000,000	25	....	......	17¾
" " "	Bds. 1929.	1,500,000	100	5	M. & N.	97⅜
ROCHESTER—						
Rochester Railway Company....	Com.	5,000,000	100	...	....	.....
" " "	Bds. 1930.	3,000,000	100	5	A. & O.	.....
ST. LOUIS—						
Lindell St. Railway.............	Com.	2,500,000	100	....	Q. J.	50
" "	Bds. 1910.	1,500,000	100	5	J. & J.	96½
St. Louis & Suburban............	Com.	2,500,000	400	....	....	50
Union Depot Railway............	Com.	1,200,000	100	...	....	.....
" " "	Bds. 1910.	1,000,000	100	6	A. & O.	100

* And interest bid.

NEW BOOKS.

Arithmetic of Magnetism and Electricity, by John F. Morrow, M. E. and Thorburn Reed, M. E. A. M., Lynn, Mass., 1893, Bubier Publishing Company, 150 pages, price, cloth, $1.00.

The object of the authors to place in the hands the public an enunciation of all those laws of electricity and magnetism, that are thought to be more directly connected with their commercial application, has been ably accomplished. The title of the book was well chosen for, as an arithmetic commences with the definition of the quantities used, then proceeds with the rules of addition, etc., so this book commences with definitions of electro motive force, current and resistance then undertakes the general laws of electric currents, etc. It is a plain and comprehensive treatise and will be found useful by the student and electrical worker.

Poor's Manual of Railroads, 26th Annual Number. ByHenry V. Poor, 1893, New York, H. V. & H. W. Poor, 70 Wall St. Chicago, A. C. McClurg & Co., 117 & 121 Wabash Ave. Price, $6.

This manual that has become the standard book of reference among railroad men appears this year still more complete and with a number of improvements. The volume is larger and contains considerable additional information. The railroad maps have been collected and are placed together near the front of the book, an arrangement which will be appreciated by the readers. The railroad statistics of the United States, their route and milage, stocks, bonds, debts, cost, traffic, earnings, expenses, and dividends, also their organization, officers, directors, etc., are more complete than previous volumes. The value of such statistics and information in one convenient sized volume is many times the price at which it is sold.

TRADE PUBLICATIONS.

In "Echoes from Electricity Building," George Cutter has given to the trade some facts concerning his specialties as well as a souvenir of the Electricity Building.

A catalogue containing illustrations and descriptions of the Hart snap switchers is at hand. The switches of the Hart & Hageman Mfg. Co. of Hartford, Conn., are well known to the trade, but this catalogue furnishes much additional information as to sizes, finishes and interior construction. The Hart flush switches and plates which have more recently been placed on the market are fully illustrated and described.

Among the recent trade publications issued is one from the instrument department of the Tice-Lintner Electric Company of Minneapolis. It contains a description of the Tice-Lintner potential indicator with an explanation of its use in central stations and isolated plants. The stock sizes of the instruments are given as for 50, 75 and 110 volt circuits for lighting plants and 250 to 600 volts on railway and power systems.

In the new catalogue issued by the Bryant Electric Company, a most complete line of switches are shown including the Bryant, Paiste and Hubbell switches. Among the specialties isted are Bryant sockets for the different styles of lamps, plain and K. W. rosettes for both cleat and concealed work, cut-outs of a great variety of kinds, main line, horseshoe and other styles of fixture cutouts, branch blocks, etc. The catalogue is well arranged and presents in an excellent manner the specialties the company manufactures.

The Royal Columbian Electric Company has issued a new catalogue. It presents to the trade in an excellent manner the alternators, continuous current dynamos, transformers, etc., which the company manufactures. The half tone engravings, with the accompanying descriptive matter, give the reader a comprehensive idea of the different machines. The new Royal alternator, recently placed on the market by this company, is specially interesting. The current is taken from the machine without collector rings or brushes, and the particular feature is that the current is generated without revolving armature or field magnets.

From the Central Electric Company comes a catalogue and price list of Okonite wires and cables, which is designated as No. 6. The design on the front cover illustrates some of the fields in which this well known brand of wire is used. For the lectric railway, the different systems of electric lighting, the telephone and telegraph special sizes and styles of wire and cables are manufactured, and under these different heads are grouped in this catalogue the kinds of wire adapted for that service. The information concerning the wire is arranged in tables which give in one line the size of wire and insulation, outside diameter of insulated wire, weight per mile, insulation, resistance per mile and price per foot. In the front part of the catalogue are tables giving sizes of wires as measured by different gauges; both the diameter and area. Thus the catalogue becomes valuable as a book of reference.

The different catalogues recently issued by the Westinghouse Electric & Manufacturing company are models of their kind. Of the same size as the catalogue of street railway apparatus, the catalogue of standard apparatus of the company contains the same high grade half tone engravings of the product of the factories of the company. It is really an album as it contains no reading matter. Circulars are issued describing the different kinds of apparatus. Transmission of Power is the title under which Mr. L. B. Stillwell, E. E., has described the systems and apparatus furnished by the Westinghouse company for power transmission. The volume opens with a brief description of the different systems of power transmission which is followed by a discussion of electrical transmission of power. The special adaptation of electricity, the matter of insulation, the forms of apparatus required and installation are each described. The book comes from the Fort Pitt Engraving Co. and gives evidence of the highest rank in the engravers and printers art.

PERSONAL.

Mr. Jos. Wetzler, editor of the Electrical Engineer is now in Chicago.

Mr. Clarence E. Stump, formerly of the Street Railway Journal, has assumed the management of the Street Railway Gazette.

Mr. George B. Muldaur, representative of the Electrical Engineer at the Fair, has returned to New York for a short time.

Mr. Geo. H. Guy, well known through his scientific reports to the daily press since attending the electrical congress, has been looking over the Fair.

Mr. M. D Law, electrical engineer of the Love underground conduit electric railway system, Washington, D. C., has been at the congress and the Fair.

Mr. M. J. Sullivan, of the Electrical World, was married on Tuesday, August 15th, to Miss Frances Read at Freeport, Ill. A number of Chicago friends attended. Electrical Industries extends congratulations.

Mr. Geo. B. Ellison, formerly engineer with the North Western Thomson-Houston Company, of Portland, Ore., has just accepted a position as engineer for the western department of the Waddell-Entz Company, with offices at 1140 Monadnock building.

Mr. H. R. Fish, Jr., Secretary of the Royal Columbian Electric Company, Chicago, has just returned from a trip to the east, where he has been perfecting arrangements looking to the increasing of the capital stock of the Company to $500,000 and the moving of the factory to Chicago. Mr. Fish also secured for his company the exclusive selling agency of the new "Maggie Murphy" lamp for the United States. Mr. Fish is a hustler and we wish him every success in his new undertakings.

Mr. Geo. P. Low, the well-known insurance inspector of the Pacific coast, is in the city accompanied by Mr. W. F. C. Hasson. Both gentlemen were the delegates from California to the Electrical Congress, and while here visited the Fair. Mr. Hasson is the special agent of the electrical department of the Fair to be held in San Francisco next winter. It is hoped to have an electricity building at this Fair, and while in Chicago Mr. Hasson will do what he can to secure exhibits for his department.

BUSINESS NOTES.

Geo. Cutter, 851 Rookery. Chicago, is sending out large quantities of Simplex wire to the Fair for putting in the extra lights on the Ferris wheel.

The Sunbeam Incandescent Lamp Company and the Star Electric Lamp Company have moved their offices from the Chamber of Commerce building to 102 Michigan Ave., Chicago.

Bartholomew, Stow & Co. expect to soon have an incandescent arc lamp of the Nutting manufacture ready for the market.

The favor with which the styles of Nutting lamps already put out are meeting is all that could be desired.

The Street Railway Gazette has issued in pamphlet form a directory of the street railway exhibits at the World's Fair. The different exhibits are arranged under headings so that the exhibits of any one kind of apparatus are grouped together.

The Cook Elevated Railway Development Company has opened an office at room 727, 218 La Salle St., Chicago, for the subscription to stock, etc. Many inquiries have already been received from parties contemplating rapid-transit construction.

The Chicago Rawhide Manufacturing Company, Chicago, reports that the foreign demand for its rawhide products is increasing in spite of the present dull times. The company has just received an order by cable for 5,000 feet of belting. It also made a large shipment of goods to Australia last week.

Mica Insulator Company, 218 Water St., New York City, is sending out a new insulator, made of pure sheet mica, which seems from the number of testimonials received to be of an excellent character. The company has just issued a four-page catalogue containing descriptive matter concerning the different specialties manufactured.

The Mosher Electric Company, Chicago, is having many inquiries and making a number of shipments of its street railway arc lamps. Among the orders recently filled are those to the South Chicago Railway; Paducah, Ky., and the Los Angeles Street Railway. The alternating arc lamp recently brought out by this company is also selling well.

The Western Electric Company, Chicago, has just secured the contract for the complete installation of a electric lighting central station for the city of Rochester, Minn. The plant will consist of 80 Western Electric Company's arc lights and 1,000 alternating incandescent Westinghouse. The entire construction of the plant will be done by the Western company.

The Enterprise Electric Company, Chicago, has just received contract for the entire electric equipment for the Medina Temple, corner Jackson St. and Fifth Ave. The McFell Electric Construction Company is doing the work of installation. The entire plant is to be wired throughout with N. I. R. wire, for which the Enterprise Company is the general western agent.

Wm. H. Bryan, St. Louis, Mo., has just removed to larger offices at 304 N. Eighth St., first floor. A valuable assistant has been secured in the person of Mr. N. W. Perkins, Jr., M.E., whose experience and ability as a mechanical engineer are well known, and Mr. Bryan is now able to promptly attend to supervision of water works, electric light and installations and all steam and power plants, also plans, specifications, tests, etc.

The General Electric Company has just closed a contract with the Brooklyn Heights Railroad Company, Brooklyn, N. Y., for two hundred electric car equipments, which includes the new G. E. 800 motor and the latest type series parallel controller. The company has also secured a contract to furnish three 1,500 K. W. generators similar to that which is operating the Intramural Railway at the Fair from the People's Traction Company of Philadelphia, Pa.

The Central Electric Company, Chicago, reports having just secured the contract for the complete installation with Okonite wire of the new Y. M. C. A. Building on LaSalle St. The company also secured the contract for the complete equipment of the great Ferris wheel with Okonite wire. The structure of this wheel being entirely of iron it was found necessary to have a very high grade of insulation and the fact that this brand was selected speaks volumes for that popular wire.

Mr. J. Holt Gates, western manager of the Waddell-Entz Company, reports the placing of a large motor in the Illinois Central depot to operate a 60-inch Sturtevant fan, and also the sale of a large number of motors for mining and power plants in Michigan. Despite the dull times this company has recently established an agency at St. Louis with Mr. Owen Ford, formerly of the Denver office of the General Electric Company; at St. Louis with Messrs. Price, Gaither & Price; at Grand Rapids with the Peninsular Electric & Engineering Company.

Electrical Engineering Company, 249 Second Ave., south, Minneapolis, Minn., formerly the Electrical Engineering & Supply Company, of St. Paul, is handling a large line of Electrical machines and supplies, including National incandescent and Standard arc dynamos, Eddy and Holtzer-Cabot motors, Paranite, Grimshaw and O. K. Weatherproof wires and electrical supplies and specialties of all kinds. The company just completed the installation of a 2,500 light alternator with the necessary transformers, etc., at Brainard, Minn., and has several large contracts on hand.

Application was made Aug. 26 for the appointment of a receiver for the Ansonia Electric Company. The cause of this embarrassment on the part of this well-known company was the temporary suspension of Wallace & Sons, of Ansonia, Conn., who were its principal stockholders. The general depression and financial stringency are the reasons given for necessity of a receivership. Wallace & Sons, however, it is reported, will resume within a few days, and it is expected that the Ansonia Company will also be able to resume business, to which end it is now working.

The Ball Engine Company, Erie, Pa., reports among recent sales the following: Through its Philadelphia representation Messrs. J. W. Parker & Co. for the power plant of Harlan & Hollingsworth of Wilmington, Del., one 150-horse power engine; a second order from the Buffalo, Belleview & Lancaster Railway for a 150-horse power engine; through its Boston representative Mr. J. H. Houston to the Waddel-Entz Company direct connected 100-horse power engine and through its Minneapolis representative, Messrs. Cooley & Vater, two 200-horse power cross compound engines directly connected to Siemens & Halske generator for the Lumber Exchange Building.

The Electric Appliance Company is making a specialty of VomCleff & Company's all-steel pliers, connectors and other electrical tools, and has on exhibition at its World's Fair space a very handsome sample board of these goods, including flat and round long-nose pliers, diagonal and end-cutting nippers, linemen's wrenches, etc. The advantage of the VonCleff all-steel goods over the English imported tools in this line is that every article of the former is warranted and replaced free of charge if it breaks down in doing the work for which it is sold, while the English goods are sold without any such guarantee, and if a flaw of any kind exists the purchaser is the loser thereby.

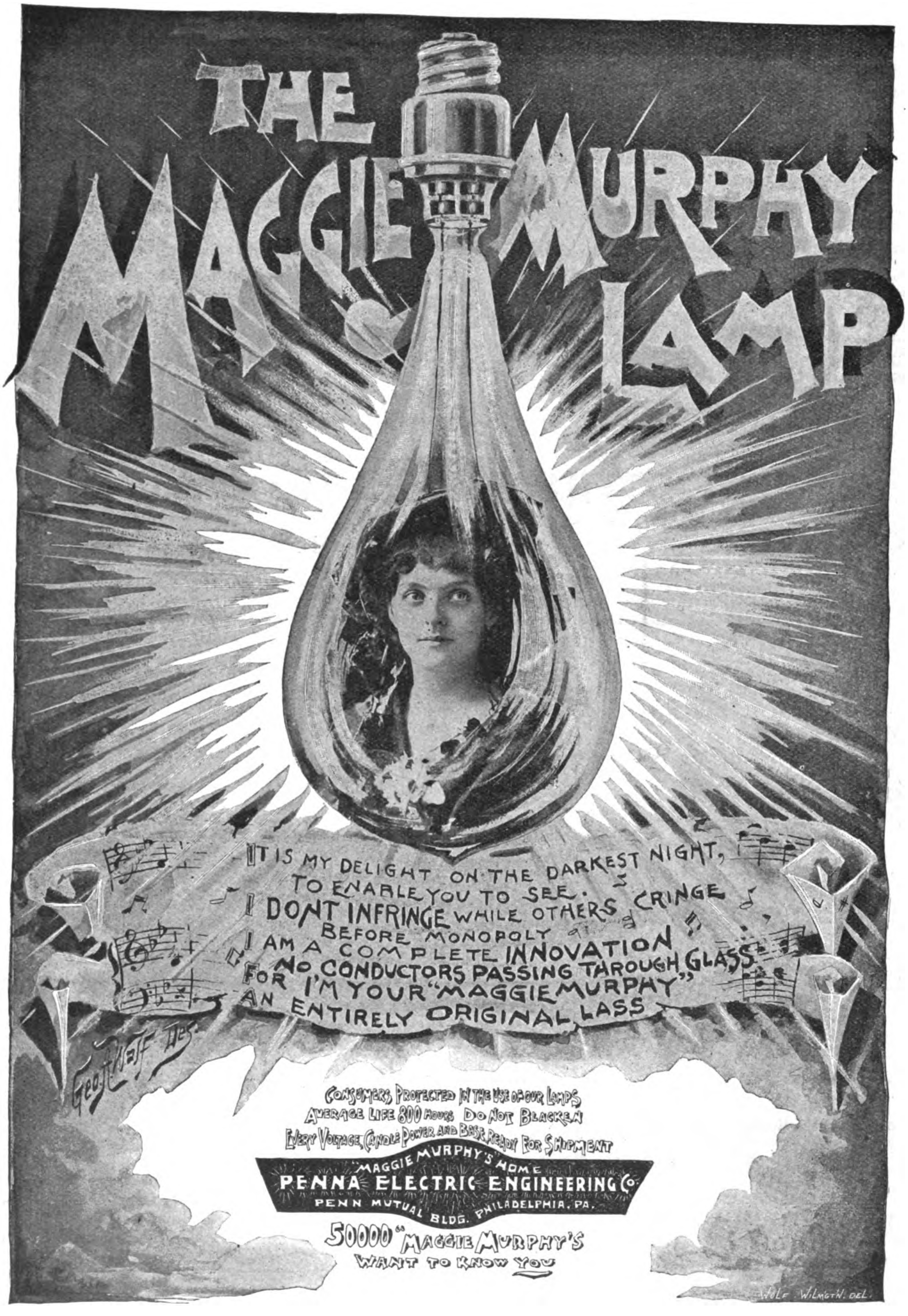
The Railway Equipment Company, Pullman Building, Chicago, report a sale of its type "G" overhead material to the Montreal Park & Island Railway Co., Montreal, Canada. Since placing this type of material on the market the company has secured, it claims, almost every large contract that has been given out throughout this country and Canada. It is claimed that this material is stronger, better insulated and easier to adjust than any other overhead material now manufactured, and in addition to this it presents a very neat appearance on the line, an item of no small importance. The Railway Equipment Company has always been considered as headquarters for electric railway supplies, the company confining itself altogether to the manufacture and sale of such supplies.

The Standard Electric Signal Company, of Rochester, N. Y., has been exhibiting at Room 96, National Life Building, Chicago, its fire alarm system in its various applications. One of the special advantages of the system is that the calls and alarms are non-interfering, so that if two or more boxes are pulled or thermostats fused at practically the same time the calls will not be confused, but one will follow the other and each will be accurately registered in the central office. A broken wire gives no alarm to the fire department, but its location is automatically recorded at the central office. It is adapted for wide ranges from the smallest village to the largest city and as many districts as desired.

The Blakeslee Manufacturing Company, Du Quoin, Ill., find an active demand for their popular style of pump. They report recent shipments to Wolf Lake, Hollis, Makanda, Okawville, Carbondale, Cobden, Decatur, Eldorado, Ava, Arcola, Pinckneyville, Kinmundy, Paris and Marion, Ill.; Stephens, Bearden and Camden, Ark.; Fort Worth, Goodwin, Galveston, San Antonio, Austin, Yoakum, Dublin, Palestine and Wades Switch, Texas; St. Louis, Kansas City, Barfield, Marshall, Mexico, St. Joseph and Elvans, Mo.; St. Paul, Minn.; Hawleyville, Des Moines, Marshaltown and Burlington, Iowa; Oshkosh, Wis.; Washington, Ga.; Cumberland, Md.; Erie and Alton, Pa.; Selma, Ala.; South Sioux Falls, S. D.; New Orleans and Shreveport, La.; Memphis, Tenn.; New York, N. Y; Louisville and Paducah, Ky. and Leavenworth, Kans. Also jet pumps to Chicago, Decatur, Danville and Peoria, Ill.; Muncie and Indianapolis, Ind.; St. Louis, Kansas City, Joplin, St. Joseph and Chillecothe, Mo.; New Orleans and Shreveport, La.; Dallas, San Antonio, Waco, Tyler, Fort Worth and Houston, Texas; Toledo, O.; Omaha, Neb.; Portland, Ore.; Birmingham, Ala.; Waldo, N. M. and Erie, Pa.

The Hoppes Mfg. Company, Springfield, O., manufacturers of the Hoppes live steam feed water purifiers and exhaust steam feed water heaters, report the following as among some of their recent shipments: To The Peoria Grape Sugar Co., Peoria, Ill., 350-horse power feed water purifier; E. D. Hornbrook & Co., Kansas City, Mo., 75-horse power exhaust steam heater; Kansas City Paper Box Co., Kansas City, Mo., 75-horse power exhaust steam feed water heater; The Ontario Malleable Iron Co., Oshawa, Canada, 100-horse power exhaust steam heater; Bartholomay Brewery Co., Rochester, N. Y., two live steam purifiers of 500-horse power each: exhaust steam heaters to Peter Young, Brooklyn, N. Y., 200-horse power; St. Louis, Mo., Furniture Workers Ass'n, 100-horse power; Kupferle Bros. Mfg. Co., St. Louis, Mo., 150-horse power: East River Gas Co., Long Island City, N. Y.. 300 horse-power; Springfield (O.) Railway Co., 600 horse-power; Jas. Cotter, Kansas City, Mo., 150-horse power; Clark Thread Co., Newark, N. J., 3 of 2,700-horse power, total capacity; American Glucose Co., Peoria, Ill., one 1,500-horse power; Hillack & Pitman Co., Logansport, Ind., 75-horse power; L. Hoster Brewing Co., Columbus, O., one 300-horse power; Kelley & Lysle Milling Co., Leavenworth, Kas., 400-horse power; Detroit Machine Screw Works, Detroit, Mich., 100-horse power, and East River Gas Co., Long Island City, N. Y., 625-horse power; to Singer Mfg. Co., South Bend, Ind., 1,000-horse power; Missouri, Kansas & Texas Trust Co., Kansas City, Mo., 75-horse power; The Elmira Illuminating Co., Elmira, N. Y., one 1,000-horse power; Citizens Gas & Electric Co., Jacksonville, Fla., 80-horse power; Orange Distilled Water Ice Co., Orange, N. J., 200-horse power; Omaha Gas Mfg. Co., Omaha, Neb., 200-horse power; Giant Powder Co., San Francisco, Cal., 200-horse power; Columbus St. Railway Co., Columbus, O., 1,000-horse power live steam feed water purifiers.

"PENNSYLVANIA"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IT IS MY DELIGHT ON THE DARKEST NIGHT,
TO ENABLE YOU TO SEE.
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BEFORE MONOPOLY
I AM A COMPLETE INNOVATION
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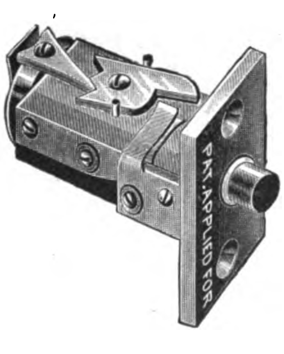

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We know of many business men who have traveled between Chicago and St. Paul over fifty times within the past five years and have never seen an inch of the track between Milwaukee, La Crosse and Winona, yet notwithstanding, they will assert that the Chicago, Milwaukee & St. Paul is the best and most attractive railway between the Great Lakes and the twin cities (St. Paul and Minneapolis). They know nothing, beyond hearsay, of the beautiful scenery through the Lake Region of Wisconsin or along the Upper Mississippi River, which a daylight ride over this great railway affords; but they back their judgment on their experience with the night train service, which enables them to start from one terminal in the evening and arrive at the other terminal in the morning. The traveler knows instinctively that the track is perfect, because there is no appreciable jolt or jar. He knows that there in not in Europe or America a more complete and satisfactory train than the Electric Lighted, Steam Heated Vestibule Limited, with its berth reading lamps and other magnificent appointments. The Dining Car service is superb. Supper is served on the train leaving Chicago each evening; breakfast on the train arriving at Chicago each morning. Is it any wonder that business men and tourists prefer this—the best—route between Chicago, Milwaukee, St. Paul and Minneapolis? Ticket Office, 207 and 209 Clark Street, Chicago.

New Equipment for the Monon.

The following is from the Chicago *Tribune* of Feb. 14th: "The Louisville, New Albany & Chicago has just added to its rolling-stock two new sleeping and boudoir cars, costing nearly $45,000 each. These cars are said to be the finest ever placed on any road in the country, and are specially designed for use during the World's Columbian Exposition."

These cars are models of elegance and beauty, each compartment or boudoir being fitted with a complete toilet set, cleverly hidden from view when not in use. They are in daily service between Chicago and Cincinnati, and should be seen and used, to be fully appreciated.

All of the Monon's through day trains are made up of smoking cars, new coaches and parlor and dining cars.

ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. October, 1893. NEW YORK. No. 10.

Electric Railway Exhibits at the Fair.

For the study and investigation of electricity as applied to street railway traction no better field can be found than is offered at the World's Fair. Whether it is the student, the manufacturer, or the street railway engineer and superintendent, each will find there the best products of every factory. The completed car and each piece of apparatus used in the car, the power house and overhead equipment are shown in the best manner possible for investigation.

The exhibitors have taken special pains to show every detail in the construction of their machines and apparatus so that there is offered at the Fair facilities for investigation and comparison such as were never, and probably will not in the near future, be equaled. The Intramural Railway has done much to advance the industry by familiarizing the millions of people who have attended the Fair with electric traction in this improved form. This model road was described in the May issue of Electrical Industries. It has carried since it was opened over 3,000,000 passengers. Its power house is worthy of as careful attention as the line, for it contains a variety of engines and generators of the latest pattern and a boiler plant and accessories of the most improved design.

On the tracks near the terminal station are exhibited a number of electric cars and locomotives as shown in the accompanying engravings. These cars are connected so as to be supplied with current, thus allowing the cars to be shown in operation. Among these cars are two general electric locomotives, one of them being the 30 ton locomotives described in the September number of Electrical Industries. The manufacture of electric locomotives having been recently undertaken, these locomotives possess more than ordinary interest. On the same track is a closed car equipped with the street car apparatus of the Sperry Electric Company, and also a private car equipped with Short apparatus. On a neighboring track stands a car of improved pattern. The car was built by the Laclede Car Company of St. Louis, and shows the finest of workmanship and materials in its construction. It is mounted on a McGuire Columbian truck, which is equipped with Westinghouse 25-horse power single reduction motors. The controlling device is also of the Westinghouse pattern. This car represents a modern car such as would be furnished by this company to a street car company desiring the most serviceable and efficient car for street railway service.

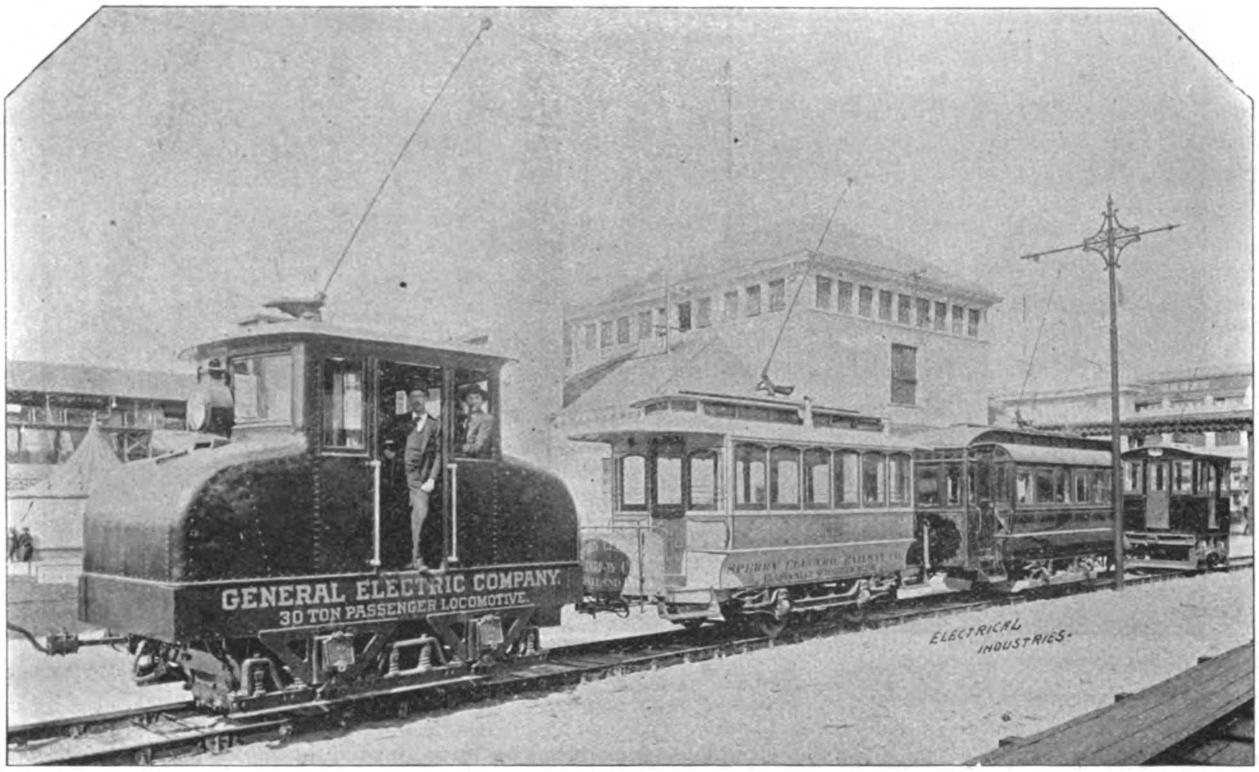


FIG. 1.—ELECTRIC RAILWAY EXHIBITS AT THE FAIR.

In the investigation of power plant machinery the greatest variety is shown in Machinery Hall. Engines and generators both directly connected and belt driven are exhibited by foreign and domestic manufacturers. But to Electricity Building the exhibits of motors and appliances are confined. Near the center of the building just north of the tower is located the General Electric Company's electric exhibit of electric railway apparatus.

In this exhibit are shown motors of different sizes attached to different kinds of trucks, starting and controlling boxes and appliances and apparatus used in the installation of a street railway system. The L. W. P. 20 motor is shown mounted on a Jackson & Sharp Co.'s truck and equipped with the New York Air Brake Co.'s air brake, the combination being the same as that on the Intramural Railway. On a Bemis truck is shown a G. E. 800 motor, and on a

Taylor truck fitted with Genette air brakes is shown a W. P. 30. In this display is also shown Robinson's radial truck manufactured by the Robinson Electric Truck & Supply Co. It is equipped with type W.P. 50 motor. This truck has been successfully used in a number of the large cities. Its special construction enables it to run on curves almost as easily as on a straight track. A 15-horse power freight truck is also shown in the exhibit of a design adapted for use among machine shops, foundries, etc.

Near the center of this space is a large switchboard on which are the various switchboard appliances used in power stations. The extensive sizes and designs manufactured by the General company are shown as well as trolley appliances and materials used in overhead construction. Multipolar generators of 133, 266 and 400-horse power form part of the display. A very ingenious method of showing in a comprehensive way the method of wiring a car has been placed on the display boards on the back of the switchboard.

The Westinghouse company has given special attention to its exhibit of street railway apparatus, and has arranged it both with reference to the decorative and practical effect. This exhibit is located just north of the Bell Telephone building between the main aisles. The display seems to include everything that can be useful in a railway power station or in an electric car. On a track over a pit at the north end of the space are placed two cars, one a Brownell 20-foot accelerator, and the other a Stephenson 18-foot car with Tackaberry truck. Both cars are fitted throughout with Westinghouse standard 30-horse power equipment, with the series parallel controller and the lamps and other devices necessary for the complete operation of the car. Stairs take the visitor beneath the cars enabling the trucks, motors, brakes, etc., to be examined. Through the glass floor the upper side of the motors may be seen from the interior of the car. The cars are supplied with a current from a 500 volt circuit so that the motors are shown in operation.

Motors are shown on frames opened so that their construction is clearly seen; field coils and other parts are also displayed. On different styles of trucks are exhibited 20, 25 and 30-horse power motors. Generators of several sizes are shown, the most noticeable of which is a 270-horse power, 500-volt generator directly connected to a Westinghouse engine forming a compact and efficient combination.

In section L the Sperry Electric Company has an exhibit devoted almost entirely to street railway motors and their application to different styles of trucks. On the McGuire truck which is fitted with an improved form of the Sperry motor is shown a flexible connection between the motor shaft and the gears at either end, which has recently been introduced. This connection is formed of a series of links so arranged that while the shaft is freely movable out of line in every direction the rotating movement is as solid as though it were a straight clutch coupling. The pinion and gear are arranged in a solid casting in such manner that it is impossible for them to become separated in the least. The motor itself is suspended from the side bars of the truck with its shaft at right angles and from this position is attached to the gears on either axle. On a frame at one end of the exhibit is displayed a motor open so that the method of construction is plainly seen. Numerous armatures and sections of motors placed about the space add to the attractiveness of the display. In the same section as the Sperry exhibit is also located the display of Short electric street railway apparatus. This company was one of the earliest manufacturers of gearless motors and in this display are shown the original types with those of more recent design. The latest design is shown in which there are three field coils and six pole pieces half of which are consequent poles. This motor runs at 100 to 175 revolutions per minute.

On one side of the space is a Dorner & Dutton flexible truck equipped with two of the latest type of 20-horse power gearless motors. The truck is supported above the floor leaving the wheels free to run. At the side of the truck is a stand on which is the rheostat and controlling device. A number of sample rheostats are exhibited show-

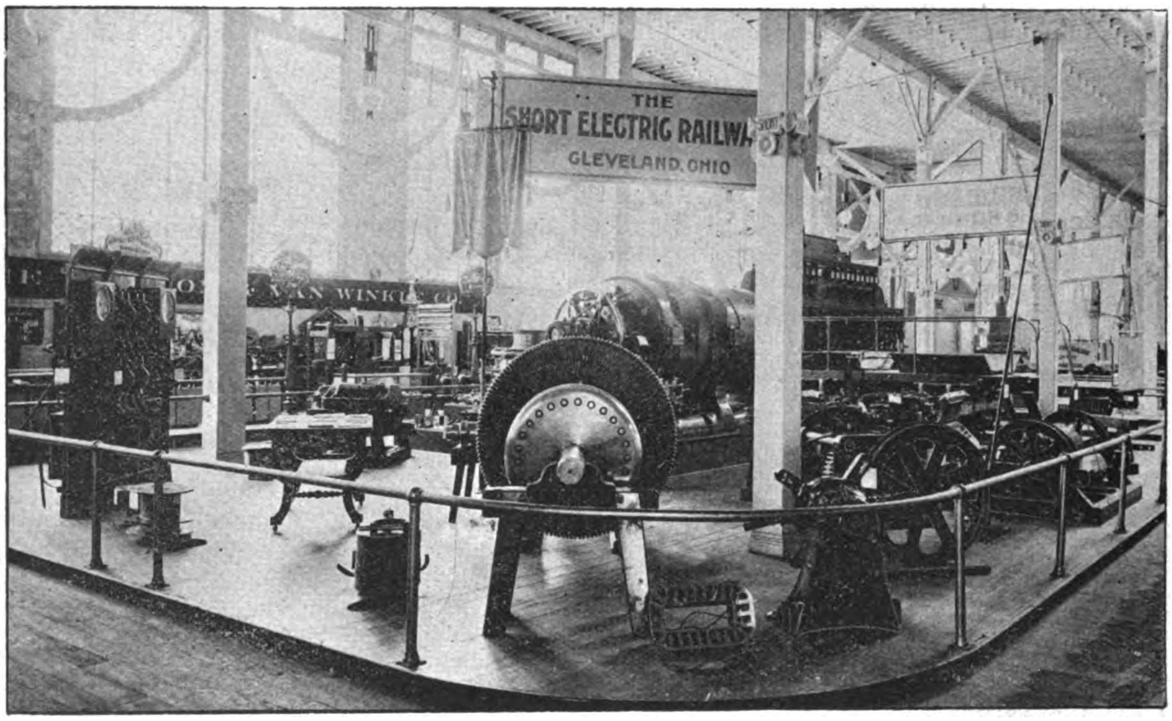
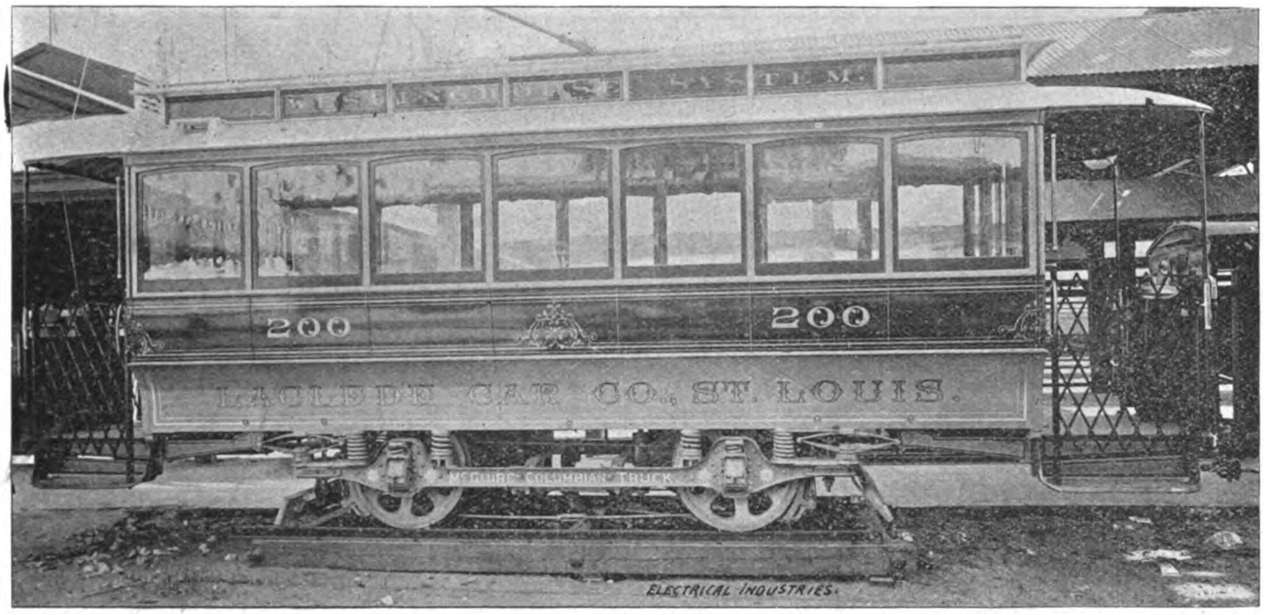


FIG. 2.—ELECTRIC RAILWAY EXHIBITS AT THE FAIR.

ing their simple but efficient construction being made entirely of iron and asbestos. Generators and appliances are also shown by a number of other manufacturers among which are the Eddy Electric Mfg. Co. which exhibits both bipolar and multipolar generators, the Brush, Mather and C. & C. companies.

The majority of the exhibits of trucks and cars are confined to Transportation Building, where in section L will be found sample cars and trucks of various styles and designs. The Pullman Company show several different styles of cars, an eight wheel double deck car equipped with Westinghouse motors and controller, an eight wheel center door car and an eight wheel double deck car with Patton motor.

J. M. Jones' Sons, of West Troy, N. Y., show both open and closed electric cars, the latter being mounted on a Taylor truck. In section L. N. 9-11 are shown open and closed cars from the Lamokin Car Works which show excellent workmanship and material in their construction. The exhibit of trucks is quite complete, the leading manufacturers being represented. Transportation Building also contains an extensive display of construction material.



FIF. 3.—ELECTRIC RAILWAY EXHIBITS AT THE FAIR.

Annual Meeting of the American Street Railway Association.

Arrangements are being made for the twelfth annual meeting of the American Street Railway Association at Milwaukee, Wednesday, October 18th, and the present indications are that it will be the most successful meeting in the history of the association. The association will assemble at 10 a. m. on Wednesday and continue in session three days.

The program of the meeting has not yet been completed but papers on the following subjects will be read and discussed:

Best Method of Lighting and Heating Street Railway Cars.

Can the T Rail be Satisfactorily Used in Paved Streets.

Direct Driven Generators.

Power House Engines.

Standard Form for Street Railway Accounts.

Standards for Electric Street Railways.

Storage Batteries in Connection with Central Stations for Utilizing Surplus Energy for Lighting and Power.

Some Practical Points in the Construction of Underground Feeders.

For the entertainment of the members during their stay in Milwaukee special arrangements are being made. The annual banquet will take place at the Plankinton House, Thursday evening, October 19th. On account of the World's Columbian Exhibition being held in Chicago, the railroads have made low rates to that point and will make no better than their World's Fair rates. The Western Passenger Association in whose territory all lines running into Milwaukee are, make a rate of a fare and a third. Thus passengers by way of Chicago will be able to secure tickets to Chicago at the World's Fair rate and between Chicago and Milwaukee at one and a third, the regular fare. This rate is contingent on the attendance outside of Milwaukee being 250 persons.

It is the intention to make the exhibition of street railway machinery and appliances the most extensive and interesting of any held and for this purpose the executive committee has secured the Milwaukee Industrial Exposition building which contains some eighty thousand square feet of floor space. In the hall of this building the meetings of the association will be held. The building has been engaged from October 9th to the 23d. thereby securing ample time for the installation and removal of exhibits.

The exhibition will be under the management of the secretary of the association assisted by Mr. A. Trumpff, secretary of the Milwaukee Industrial Exposition Association. About 15,000 square feet of space has already been applied for and numerous applications for concessions have been received indicating that the exhibits of street railway apparatus will comprise the products of most of the manufacturers of goods used in this industry. Power will be supplied to all who desire to show machinery in operation either in the shape of steam or from the shafting, that runs the entire length the building.

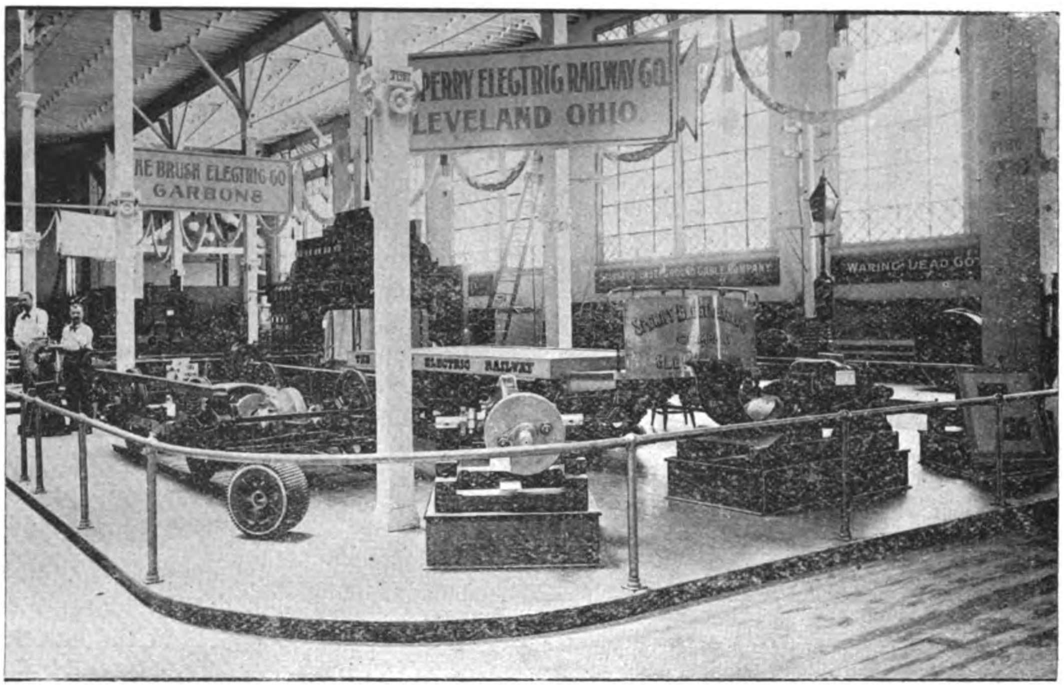
Those desiring to attend would do well to correspond with Mr. F. H. Whitney, in care of the Milwaukee Street Railway Company who is secretary of the committee on entertainment.

A New Incandescent Arc Light.*

BY L. B. MARKS, M. E.

Electrical literature is replete with studies of the incandescent lamp as a source of artificial illumination; the performances of arc-lights under a great variety of conditions have also been published from time to time. But the subject of the so-called incandescent arc, singularly, has received little or no attention.

In view of this fact it has seemed desirable to report at once, on a series of investigations, which, though still incomplete, have disclosed some remarkably interesting and important phenomena with reference to a new form of incandescent arc-light. The experiments have been carried on far enough to demonstrate that this source of illumination is *sui generis*. While possessing the main characteristics of the ordinary arc, it is also akin to the incandescent light, and may be said to constitute a mean between these two.



FIF. 4.—ELECTRIC RAILWAY EXHIBITS AT THE FAIR.

The incandescent arc has been described as one in which the "two electrodes are in imperfect contact," the current thereby meeting with a high resistance and producing heat effects, which manifest themselves in the incandescence of one electrode and the formation of a number of very small arcs between the uneven parts of the electrodes in contact.

On this principle, Reynier, Werdermann, Joel, Tommasi and others constructed lamps years ago, but for well known reasons none of these "semi-incandescent" lamps, as they were called, found much practical application. The Sun lamp of Clerc and Bureau was a modification of the others, the arc impinging on the surface of a block of marble or condensed magnesia betweeen the tips of the electrodes. In this form there was a rapid waste of the non-conducting substance interposed, and a diminution in the efficiency of the light.

The incandescent arc to be treated of in this paper, differs radically from any of the forms alluded to above. In it, the electrodes are not in contact, while the current is indirectly used in maintaining all the products of disintegration of the carbon in a state of incandescence or opalescence.

The cut shows the main features of the appurtenance. It will be seen that the arc is enclosed in a small envelope, which is made of highly refractory glass. The envelope is closed at the bottom and provided on top with a metal plug having an opening in it just large enough to admit of the feed of the upper electrode. A fire-proof plug of asbestos-pulp insulates the metal from the glass. A valve shown in the plate allows the egress of gas, but prevents ingress of the air. With this construction the operation of the lamp will be as follows:

Upon the closure of the circuit, and the springing of the arc, the air in the enclosing envelope is robbed of its oxygen, the latter uniting with the carbon of the electrodes to form CO and CO_2 gases.

The gases are brought to an exceedingly high temperature at which they maintain the carbon-vapor issuing from the arc. This vapor is deposited in the form of a thin coating on the internal surface of the glass chamber.

The expansive force of the gases may become sufficiently great, if no means of egress be provided, to rupture the envelope, hence, a small safety valve is provided for their outflow. The only possibility of ingress of air is through the narrow space between the positive carbon and the plug; experience has shown that after the temperature has been raised beyond a certain point the amount of air that enters in this way is inappreciable; in any event, the oxygen is immediately converted by combination.

It is important that the enclosing glass envelope be as small as possible, for the conservation of the radiant energy, and hence the efficiency will depend largely upon the size of the chamber. The heat which, in the ordinary arc-light is dissipated in the air, is here conserved and raises the temperature of the enclosed gases and vapor of carbon. The proper conditions being fulfilled, the lamp maintains its maximum efficiency shortly after the current has been passed through it, and glows like the incandescent with the brilliancy of the arc-light. The arc proper is scarcely visible, but the entire contents of the chamber seem to be luminous, giving the appearance of a solid cylinder of light.

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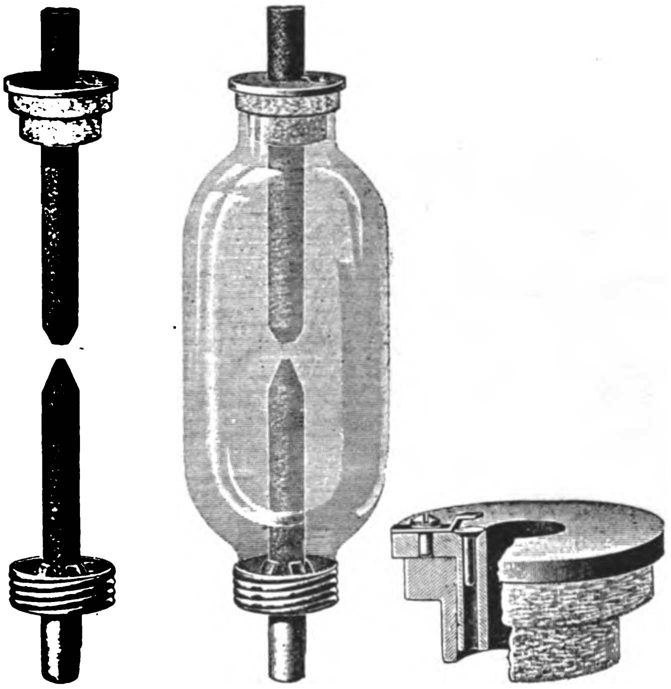
* Abstract of paper read before the International Electrical Congress.

The pressure, as well as the temperature of the enclosed gases has a very important bearing on the performance of the lamp, and affects to a marked degree the character of the carbon deposit on the glass chamber. At this date no definite figures can be given, but it appears that a high tension is absolutely required to give good results.

The structure and constituency of the electrode are also pre-eminently important. Absolute purity of the carbons is imperative.

Investigators in this field have apparently found it impossible to obtain all the requisite conditions. Beardslee mentions a type of lamp similar to the one under discussion, but whether the size or character of the arc-enclosing chamber, the nature or management of the gases, or the quality of the electrodes, or other features made his arrangement impracticable, is not recorded. Suffice it to say, the comparatively poor grade of arc-light carbon manufactured ten years ago would alone explain his failure.

It is interesting to note here that attempts have been made at various times to save carbons in arcs by excluding the oxygen of the air. Baxter devised several forms of arc lamp with this object in view. The subject has been more recently referred to by Thompson. These experiments were attended with little practical success, not because the desired ends were infeasible, but probably because, as in the case of Beardslee's apparatus, alluded to above, one or more of the requisite conditions had not been attained. It appears that the saving in life was more than counterbalanced by the loss in light. The "incandescent effect" was absent, and the unsteadiness of the arc itself was fatal. The results were almost identical with those obtained when the arc is formed in vacuo. In this case there is a tendency of the carbon to deposit as a soot on the sides of the vacum chamber, an effect consequent upon the vaporized carbon in the arc being carried off and condensed again, as soon as the vapor escapes the heat of the arc stream.



A NEW INCANDESCENT ARC LAMP.

But the requisite conditions hereinbefore named being once attained, the arc is really a beautiful phenomenon. It differs in many respects from the arc in open air, being especially steadier than the latter. The light, emanating from the incandescent vapor of carbon appears to issue from all parts of the small enclosing envelope, the area of the source of illumination being limited only by the size of the chamber.

Measurements of the efficiency and candle power of the light were made in the laboratory of Cornell University. The method employed in making the efficiency tests was that used by Nakano in determining the efficiency of the arc lamp, and subsequently by the writer in an investigation on arc-light carbons. The value of the mean hemispherical efficiency is found to be 8.4 per cent. The mean efficiency of the ordinary arc is about 10 per cent. The mean efficiency of the incandescent lamp, according to Merritt, is rather below than above 5 per cent. The value obtained in the test of this new light therefore lies between those of the two present forms of electrical illumination. approaching, however, more nearly that of the arc.

While it is true that the average efficiency of the electric arc in open air nets about 10 per cent, it is questionable whether in commercial practice in this country this value is often reached. The writer has made tests of a standard brand of arc light carbon where the efficiency was only 7¾ per cent.

Oxygen being practically excluded from the arc enclosing chamber, prolongation in the life of the electrodes is an implied concomitant.

In the ordinary arc while the positive carbon loses by volatilization from its tip or crater, and by combustion from its sides, the negative gains no deposit, but wastes at a less rate than the other, and by combustion only.

Hence, if the exclusion of oxygen were complete, we might expect an indestructible negative. This condition, however, has not been fulfilled in any of the tests made thus far, but the results fully substantiate the theory. Absence of combustion on the one hand, and the tension of the enclosed gases on the other, combine to greatly reduce the amount of disintegration of the positive electrode.

Table I gives the results of life tests with a pair of pure carbons, ½ in. diameter, and specially constructed for the purpose.

The lamp was placed in the circuit of a constant current dynamo, running about eight hours per day; readings were taken at given intervals, and the total length of run was limited to 100 hours.

TABLE I.

Life Tests.—½ in. Carbons. Mean Currents 9 9-16 Amp. Mean P. D. 55 Volts.

Initial length (x) carbon (inches)	Initial length (—) carbon (inches)	Duration of run (hours)	Loss in length (x) carbon (inches)	Loss in length (—) carbon (inches)	Life per inch (x) carbon (hours)	Life per inch (—) carbon hours
10.31	4.63	100.	6.81	0.69	14.67	145.45

Thus making 1.69 inches per hour as the average consumption of carbon in the commercial 350 Watt Lamp, run at 5½ amperes and 50 volts, we note that although 525 watts, or one and one-half times the energy have been expended in the case of the lamp under consideration, yet the life per inch of carbon consumed is more than twenty times that of the other. Indeed the figures show that the life of the negative was nearly one hundred times as great as that obtained in commercial practice today.

The preservation of the negative is a very interesting feature of this type of lamp. There is a marked tendency towards deposition of the products of volatilization of the upper electrode, on tip of the lower, the carbon deposited, if not ruptured by the action of the lamp, forming an internal part of the negative.

In one case where, the arc having been sprung, the electrodes did not come in contact during the entire run, this "building up" process was beautifully exhibited, the negative electrode gaining practically all that the positive lost. The current in this instance was 10½ amperes, and the P. D. 50 volts. The duration of the run was eleven hours.

The effect of the enclosed gases on the form and character of the arc presents a large field for investigation.

On account of lack of sufficient data no attempt will now be made to state much of a definite nature regarding this subject; but it is hoped that the matter will be given due attention in the near future.

The difference in potential between the electrodes being equal, the incandescent arc is longer for a given current than the ordinary arc; under some conditions it has been found to be almost twice as long. If we accept the conclusion of S. P. Thompson, that "the arc is independent of the nature of the surrounding gas," we must then look to the effects of the tension or pressure of the heated gases upon the arc to explain this difference in length. It has been found that there is a constant increase of P. D. with pressure above atmosphere, for a given current and length of arc. But in spite of this fact the decrease in resistance of the arc under the conditions named appears to allow of a greater length for the same P. D.

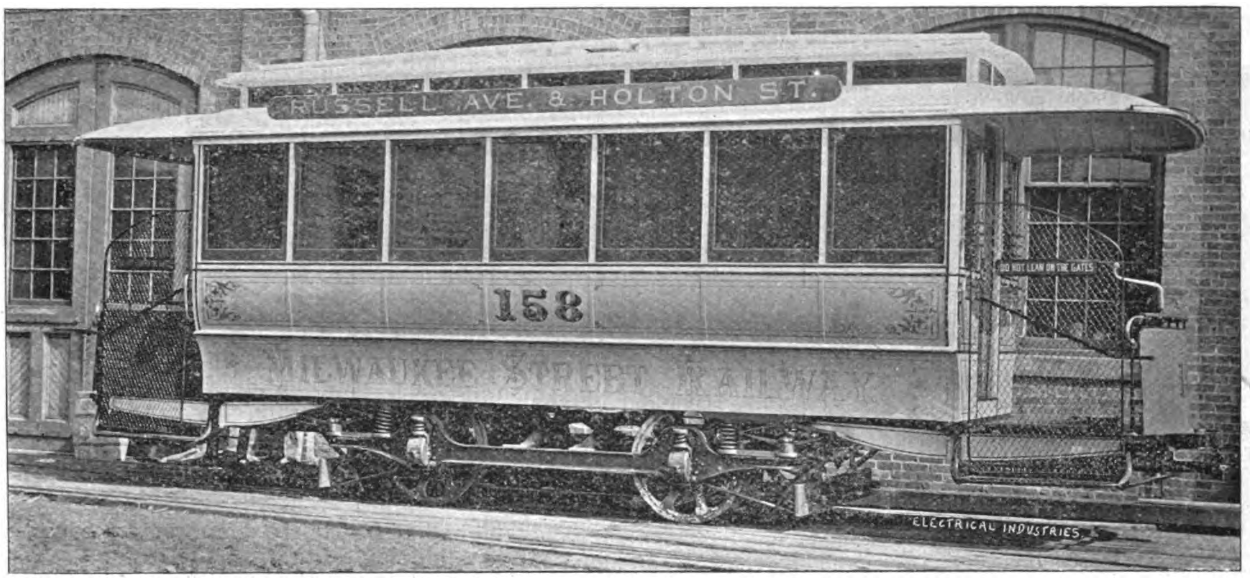


FIG. 1.—NEW EQUIPMENT OF THE MILWAUKEE STREET RAILWAY.

In the ordinary arc the carbon vapor carried off from the positive is consumed by the oxygen of the air before it can deposit on the negative. Hence the ever present "zone of flame" as distinguished from the arc-flux proper is really a zone of combustion. In the incandescent arc, however, there is naturally no zone of flame, consequently the phenomenon of flaming common to the ordinary arc, does not occur. The arc tends to center itself, being probably aided in so doing by the pressure of the surrounding gases; moreover, the slow consumption of the electrodes lessens the tendency to wander. With cored carbons there is a perceptible crater, but with solid pencils the tips become more or less flattened.

The quality of the carbon has an important bearing on the P. D. between the electrodes. Generally speaking, it has been observed that with soft fine-grained carbons the P. D. is considerably lower for a given current than with harder or coarse grained pencils. The tendency to hiss, however, is not so marked when the electrodes are consumed in the gas chamber as in the open air; in the former case the disintegration is so slow that the "electrolytic" vaporization, as it has been called, does not appear to explode the particles. It is interesting to note here that these results confirm a theory of hissing advanced by Prof. Thompson a few years ago.

No measurements were made using the alternating current; but the appurtenance was applied to the alternating current arc-lamp to determine the effect on the noise of the arc. The hum was in a large measure reduced, but whether the reduction was due mainly to the mere fact of the arc being enclosed in an air-tight compartment or not, is questionable. But, as the hum became much slighter after the lamp had been in operation several minutes, the action of the heated gases being then manifest, it is plausible that the diminution in the noise was not due entirely to the shielding property of the gas envelope.

While it has been proven that "the humming of the alternating current arc is due to the rapid periodic extinction and re-establishment of the discharge," the singing tone may be greatly modified, if not entirely overcome, by the substitution of any incandescent arc of the Reynier type. A few years ago the writer had occasion to test an alternating current arc-lamp trimmed with carbons which had been provided with a core of pulverized mica and carbon. The springing of the arc was accompanied by the usual "hum," but as soon as the mica fused, the noise ceased. The conditions were similar to those of an incandescent arc, the plastic mica-carbon core constituting a high-resistance medium between the plus and minus electrodes. There was really no true arc. The amount of light was naturally greatly reduced. In the case of the incandescent arc first alluded to, there seems to be an approach to these conditions, the arc-stream acted upon by the gases enclosed in the chamber appearing to have a greater density, if we may call it that, than under normal circumstances. The amount of light in this experiment was, however, apparently as great as in the direct current tests.

Unquestionably this form of incandescent arc must have a wide application to the arts. As a substitute for the ordinary arc-light, where greater steadiness or longer life is required, its superiority will be manifest. And its utilization, where at present the incandescent lamp is the only satisfactory source of illumination, also presents a large field. The effective distribution of liminous energy and the color of the light make it for many purposes a desirable mean between the incandescent and the arc.

As a standard source of illumination for arc-light comparison and measurements, it may be of much scientific as well as utilitarian importance.

The investigations have been carried out under the direction of Mr. Louis E. Howard, and many of the facts herein stated are due to him. The writer is also indebted to Dr. Edw. L. Nichols, Franklin L. Pope and Robt. H. Head for valuable suggestions; to Mr. C. Ransom for life tests, and to Messrs. Wm. C. Hubbard and E. S. Ferry for assistance in the efficiency and candle power measurements.

The New Equipment of the Milwaukee Street Railway.

The Milwaukee Street Railway Company recently received from Pullman's Palace Car Co., about 100 new cars of the latest pattern, specially designed for electric traction. Of this number 71 are of the closed motor car style and are models of neatness, durability, and excellence of finish. They are designed to seat 25 persons, being 27 feet 10 inches long over all and the body of the car 18 feet 7 inches.

The general appearance of these cars is well illustrated in Fig. 1 taken from a photograph. The platforms are four feet long with Stanwood steel steps and foot gongs. The bumpers are of the Railway Co's. standard with Van Dorn radial draw bars. Each car is equipped with sand boxes and provided with three removable wire gates. The trimmings are bronze throughout and the interior is finished in quartered oak with the ceiling decorated in that wood. The glass is of an excellent quality of double thick French glass in both the windows and doors. The upper deck is furnished with crystalized stained glass. The seats have been finished in two styles; in a part the seats and backs are covered with Wilton carpet, and in part with perforated veneer. The flooring is of yellow pine which is covered with Everitt floor matting. The cars are arranged for the Calorific heater. They are mounted on McGuire Columbia trucks which have a six foot six inch wheel base, 33 inch cast wheels with two inch tread and five-eights inch flange. The cars are wired for electric lights and the trolley; are equipped with General Electric 15-horse power double reduction motors.

The balance of the new equipment consist of 25 open cars designed for summer and excursion traffic. The body of these cars is 20 feet 8 inches long while the car over all is 29 feet 10 inches. These cars, having two double stationary seats and six reversable seats, will seat 50 persons. The electrical equipment and trucks are the same as the closed cars except the wheels which have a two and one quarter inch tread and three quarter inch flange. The posts are of ash finished in natural wood; the ceiling of three ply birch and the trimmings bronze. Hartshorn roller and storm curtains are provided and at the ends double thick French glass windows.

This equipment places this company in excellent shape for handling the street car traffic of Milwaukee.

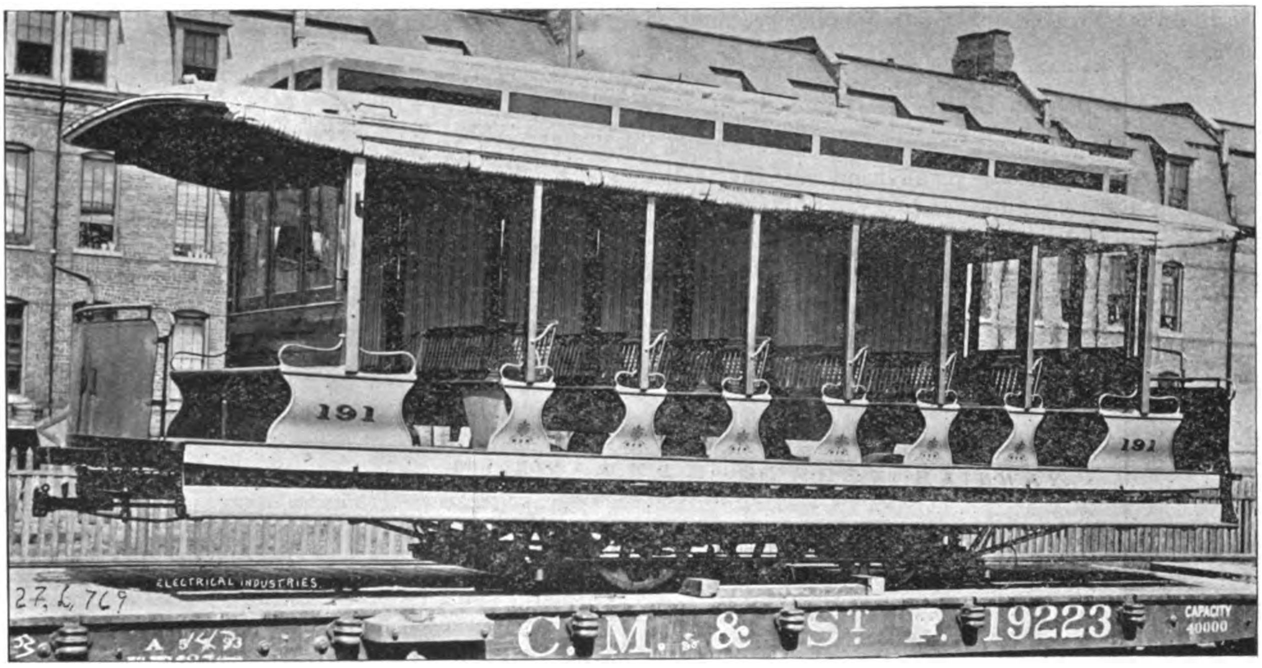


FIG. 2.—NEW EQUIPMENT OF THE MILWAUKEE STREET RAILWAY.

Annnal Meeting of the New York Street Railway Association.

The eleventh annual meeting of the Street Railway Association of the State of New York was held in the parlors of the Rochester Chamber of Commerce, Rochester, N. Y., on Sept. 19. There were present representatives from fifteen street railways of the state and a large number of interested visitors. Vice-President Hasbrouck presided in the absence of the president, Mr. C. Densmore Wyman, whose letter of regret was read to the association.

The opening address of the vice-president was full of interesting anecdotes and descriptions of the early means of transportation over both long and short distances. In the report of the executive committee presented it was shown that five companies had joined the association during the year, and that three companies had been consolidated leaving the present membership 28.

Reference was made to the subject of electric traction, in which the committee said: "We are glad to note the rapid development of the overhead system in Brooklyn. An object lesson as to character of construction, equipment and operation by electricity is there being given to the country and the world at large that will do much to pave the way for the successful introduction of electric traction in those cities where it has not yet obtained a foothold."

The committee congratulated the fraternity that during the last session of the state legislature not a single bill aimed at the successful operation and conduct of the business had become a law. All that was asked for the business was that the same consideration and fair treatment be extended to it as to any other business.

The business outlook was touched upon as follows: "The street railway business is a delicate financial meter that indicates with a certainty the financial condition of a people. In proportion to the prosperity of the people is our business successful; and the converse is equally true. Judged by this infallible test, therefore, we are assured that the worst of the country's financial troubles and business depression of the country is passing away." In closing the report a fitting tribute was paid to the memory of the late John Stephenson.

The treasurer's report showed that the receipts during the year had been $902.49 and the expenses $678.66, leaving a balance of $223.83.

One of the most interesting features of the meeting was the paper by Mr. T. J. McTighe on the "Return Circuit for Electric Railways," which appears in another column of this issue.

American Search Lights at The Fair.

National pride will no longer suffer on account of the presence at the Fair of a number of search lights exhibited by foreign makers. America again demonstrates, that she is not to be conquered and the beams of the American lights confidently pierce the sky, along side those of foreign make. The first lights supplied to the United States Navy were manufactured in France, but more recently they have been made by the General Electric Company, except the reflectors which up to the last year or two have still been manufactured at a French factory. But an American firm has shown that it can make a reflector as perfect as is possible to be made and that will stand the intense heat which always attends the presence of such great electric arcs. The two lights, the one on the Casino and the other on the Music Hall, are each of the 30 inch marine search light projector type and the some style as the one used on Mt. Washington, N. H. which was placed in position about two years ago, and are rated at 100,000 candle power. That light on account of its advantageous position can be seen in Portland, Me., some 80 miles away and in localities 5 or 10 miles away the light is sufficiently strong so that a newspaper may be read. On the battleship, Illinois, are two 30 inch marine search light projectors which are used nightly. These lights are automatically regulated and controlled.

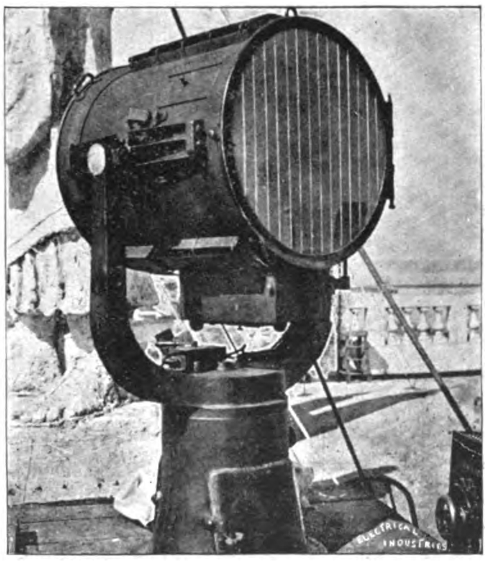


FIG. 1.—AMERICAN SEARCH LIGHTS AT THE FAIR—ON THE CASINO.

The large cylinders respond immediately to the slightest movement of the switch on the controlling device, which may be placed at any distance from the light. The ammeters, volt meters, resistances, switches, etc., for the control of the current and the movement of the light, so as to throw the beam on any desired point have been arranged on a frame which requires but a very small area of floor space and yet which places the levers and switches on the outside, easy of access. The accuracy and sensitiveness of the controlling device is best shown in the exhibit of the General company in Electricity Building, where has been erected a small tower on which is placed a 12-inch projector. On the floor at the base is placed what in this case answers the purposes of a switch board, but differs greatly in form and appearance. On the top are the ammeter and voltmeter and on the face the rheostats and switches, the wires leading to the base of the search light on the tower. But one motor is used to secure the up and down motion and one for the horizontal movement which is communicated from the motion through the gears to the projector. The positive motor being secured by turning on the current and is regulated by regulating the supply of current. The motion is reversed by changing the direction of the current through the fields of the motor which is accomplished by a very ingenious switch.

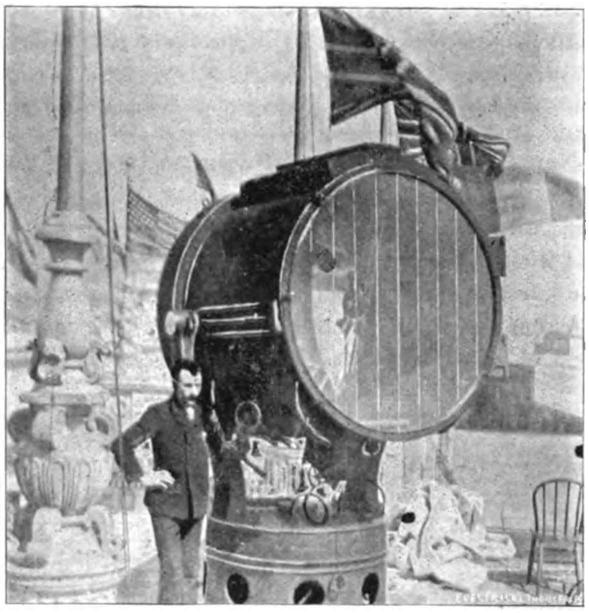


FIG. 2.—AMERICAN SEARCH LIGHTS AT THE FAIR—ON THE CASINO.

The carbons of the lights are selected of such relative sizes that the upper and lower carbons will be consumed at an equal rate so that as both carbons are moved the same distance by the regulating device, the arc will be maintained at the same point and the light properly focused. The most powerful search light at the Fair and around which the greatest interest centers, is the one recently placed in position on the colonade, just north of the stock pavillion. It is said to be the largest search light ever constructed and has an estimated candle power of 375,000,000. It stands 10 feet 6 inches high over all and weighs about 6,000 pounds. The mirror is three and one-fourth inches in diameter at the edges, one sixteenth of an inch at the center and weighs about 800 pounds.

The metal ring in which it is mounted weighs about 750 pounds, and the total weight of lens, ring and cover weigh about 1,600 pounds. This great mirror is mounted at one end of the big drum, the outer end of which is furnished with a door consisting of a metal rim, in which are fixed a number of plate glass strips five-sixteenths of an inch thick by six inches wide. Inside this drum and sliding upon ways arranged on the bottom, is placed the electric lamp, the source of the light which is reflected by the mirror. It is entirely automatic in its action, is six feet high and weighs 400 pounds. The upper or positive carbon is one and five-eighths inches in diameter and twenty-five inches long, with a five-sixteenths of an inch core of soft carbon running from end to end through its center. The lower or negative carbon is one and one-fourth inches in diameter, is fifteen inches long and also has a core of soft carbon running through its center, one-fourth inch in diameter.

In addition, its outer surface is heavily coated with copper. The positive carbon is set a little in front of the negative, and thus almost all the intense light of the incandescent crater is cast upon the reflector. The maximum current at which this lamp operates is 200 amperes, and at this current the lamp has a luminous intensity of about 90,000 to 100,000 candles, the reflected beam a total luminous intensity of about 375,000,000 candles, an intensity which the eye cannot appreciate. In looking at the side of the beam the spectator only distinguishes a stream of light of comparatively low intensity, but in looking at the beam directly its brilliancy is fully seen and the effect is absolutely blinding, the center of the beam being of the most intense brightness.

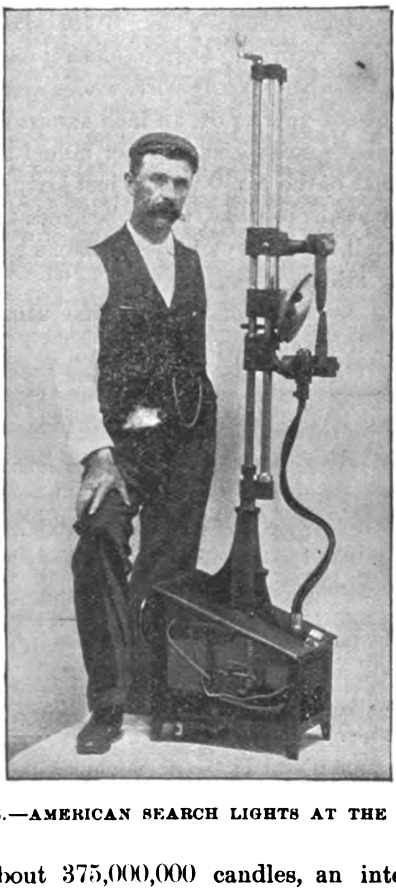


FIG. 3.—AMERICAN SEARCH LIGHTS AT THE FAIR.

Ventilators at the top and sides allow a constant current of air to pass through the drum and dissipate the heat generated by the arc lamp; and they are so arranged that no light can escape through them. All the connections for adjusting the positions of the carbons and the lamp are brought through the drum to the outside, and are arranged in close proximity to one another at one side so that all may be manipulated by the operator without moving from his position. Through openings in the drum covered by densely colored glass the operation of the lamp may be watched, and its adjustments verified. On the face of one of the plates of colored glass is shown the arc and carbons reproduced in miniature of perfect clearness and exactness.

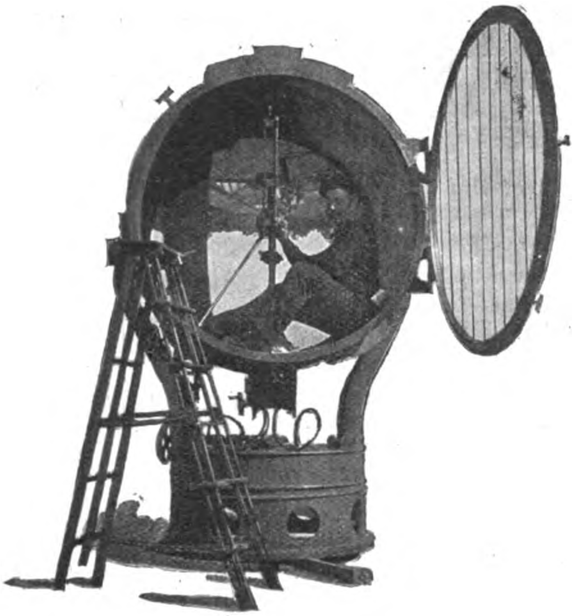


FIG. 4.—AMERICAN SEARCH LIGHTS AT THE FAIR.

The drum is supported by trunions in bearings at the top of a Y-shaped fork, set in a base plate, and the whole is supported on a system of friction wheels, forming a turntable resting upon the top of a massive pedestal supporting the whole structure. The drum, fork and base plate may be rotated horizontally on the turn-table either by hand or by gearing provided for this purpose. The drum may also be elevated or depressed in a vertical plane by similar gearing.

The great disadvantage under which these lights are placed being near the ground and between the buildings, prevents their full power being seen, but the intense brightness of the tower of the Illinois building, when the great projector on the colonnade, a mile away, is turned that way, shows something of the power of this search light. Many unique effects are produced by these lights, especially in the clearly defined dark shadows.

Resolutions on the Death of Louis W. Burnham.

At a recent meeting of the Board of Directors of the Electric Gas Lighting Company the following resolutions were passed by the board:

WHEREAS, Louis W. Burnham, vice-president and general manager of the Electric Gas Lighting Company, departed this life August ninth, after a brief illness; and

WHEREAS, the board of directors of the company desire to put on record their high appreciation of their deceased associate, and deep sense of the great loss which the board and company has sustained; therefore,

RESOLVED:—That in the decease of one who has been so constant, so able and so indefatigable in developing and advancing its interests this corporation has lost an officer whose strength, energy and integrity of character were invaluable; and the board has lost a member for whose manly character his associates entertained a high personal regard, and upon whose aid in their common duties they have long and confidently relied.

Resolved:—That the directors hereby tender to the family of their late associate their heartfelt sympathy in this sudden bereavement.

Resolved:—That these resolutions be extended upon the records of the corporation, and a copy of the same be sent to the family of the deceased.

Report of the Committee on "The Return Circuit of Electric Railways." *

BY THOS. J. McTIGHE.

The progress of the trolley system of electric railways has been so rapid as to become almost bewildering. A multitude of improvements had been added, the necessary result of careful thought and ingenuity of the electrical engineer, and the critical study of the practical railway manager and his assistants. But this has been mostly true of the track and overhead construction and the cars and power equipment. The return circuit has been rather neglected, being largely a case of out of sight, out of mind. Originally installed on a basis evidencing immature study, and necessarily without experience, it has been left to shift for itself, or rely upon mother earth to open a frictionless path for the nearly exhausted pressure to get back to the power house. Few practical investigations of efficiency have been made, and data are meager. Yet the return circuit is in some respects quite as important a factor of the system as the overhead circuit, and a moment's thought will show this to be true. The efficiency of an electric circuit depends upon the resistance of all the parts. We carefully figure out the amount and size of overhead wire so as to bring down the waste of energy in transmitting current to the motors, and we should be logically bound just as carefully to plan out the return circuit. There is this important difference, too, in our favor in the latter case, that, while we must have all copper overhead, and consequently must struggle with the specter of cost, when we get in the ground we have a veritable tower of refuge present in the rails, if we but choose to take proper steps to avail ourselves of their valuable help. Track rails are necessary, and they are getting better and bigger for our circuit purposes, and I believe that it will not be long before the absurd and costly supplementary wire will have joined the vast army of discarded expedients, and with it the earth as a permanent part of the return circuit, except in some special cases.

We are told in mechanics that the strength of a structure is measured by that of its weakest part under the most unfavorable conditions it is to meet. Similarly, in a compound electric circuit, the total resistance must depend upon the condition of highest resistance to be met with in any of its component parts. We must plan so as to have our return circuit efficient in the most prolonged summer drought, and in the most severe frosts of winter. Ground plates and pipes laid below permanent water level are a refuge in a few favored localities, but the same can hardly be said of plates and pipes laid in the ground whose moisture depends upon the wayward elements.

I have made a large number of calculations as to what should be the total resistance per mile of the return circuit under different methods of the construction of the circuit.

In making these calculations I have eliminated the conductivity of the earth, because in average winter weather the earth turns a very cold shoulder to the track. I have eliminated the conductivity of the fishplates, because I believe that under average conditions the comparatively small areas of contact surface are too much oxidized to be of much benefit. The most approved form of fishplate bears only at its upper and lower edges against the rail.

I have eliminated all the refinements upon which exact scientific analysis of the subject would insist, such as changes of temperature, moisture and other conditions which are more or less insignificant in the practical work. I have based the figures on the ratio of 6 to 1 in comparing the resistance of the ordinary soft steel rails with that of our usual commercial copper, and for the latter I have followed the ordinary tables adopted by the wire manufacturers.

In steel rails we usually say that every ten pounds weight per yard means one square inch of cross sectional area. And every square inch of such area can be brought to terms of copper by dividing by six. The resistance is easily determined, and we thus readily arrive at some important results for comparison. For example, take the average city railway rail as being a seventy pound girder. Its area is substantially seven square inches, and the four rails of a double track make twenty-eight square inches, equal to a single steel bar four inches thick by seven inches wide. This is electrically equal to a bar of copper having 4.66 sq. ins. area, or, in other words, a copper conductor one inch thick and almost five inches wide. With such a magnificent path for our returning current, does it not seem absurd to supplement it with a No. 0 wire, whose area is that of a rod a little over a quarter of an inch square? But when we find the above rail resistance per mile to be but .0086 ohm, while that of the No. 0 wire is just sixty times greater, the absurdity seems to grow, and it becomes a case of sending a very small boy to do a very big man's work, with the man standing idle on the spot.

Calculating in like manner for some usual weights of rails, I obtain the following:

TABLE I.—DOUBLE TRACK.

Size of Rails.	Total Sectional Area	Equivalent in Copper.			Resistance per mile.
		Area.	Thick.	Wide.	
50 lb.	20 sq. in.	3.33 sq. in.	1 in.	3.33 in.	0.0121 Ohm.
60 "	24 "	4.00 "	1 "	4.00 "	0 0101 "
70 "	28 "	4.66 "	1 "	4.66 "	0.0086 "
80 "	32 "	5.33 "	1 "	5.33 "	0.0075 "
90 "	36 "	6.00 "	1 "	6.00 "	0.0067 "

As it would be tedious to carry all these into further comparisons, I will carry the analysis out mainly on the seventy pound rail, with one reference to the big ninety pound rail now being extensively used in large cities.

TABLE II.—70 LB. RAIL, DOUBLE TRACK.

Case.	DESCRIPTION.
1	No. 4 cop. bonds, connectors and two No. 0 cop. supplementaries.
2	No. 4 cop. connectors to rail ends, two No. 0 cop. supplementaries.
3	36 inch No. 0 iron bonds, single No supplementary.
4	36 " " 0 " " double. " "
5	36 " " 0 copper bonds, single. No supplementary.
6	12 " " 0 " " " " "
7	36 " " 00 " " " " "
8	12 " " 00 " " " " "
9	36 " " 000 " " " " "
10	12 " " 000 " " " " "
	90 LB. RAIL. DOUBLE TRACK.
11	No. 4 cop. connectors to rail ends, four No. 0 supplementaries.
12	12 inch No. 0000 copper bonds. double. No supplementary.

Taking the various cases set forth in Table II, I have constructed another table, and for the sake of fair comparison I have made the calculations on the same basis of elimina-

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*Report presented to the Street Railway Association of the State of New York at its annual meeting Sept. 19th tion as previously noted. I am not aware that the subject has heretofore been followed up to this extent, and I think it will be found interesting and perhaps important.

TABLE III.—CHARACTERISTICS PER MILE, DOUBLE TRACK.

Case Number.	Total R of Rails.	Total R of Rail Bonds.	Total R of Track Circuit.	Fall of Potential for 200 Amp.	Total Energy Expended thus in Track Circuit.	Cost of such per Year at $100 per Kilowatt.	Approx. Cost of Track Circuit Material.
	Ohms.	Ohms.	Ohms.	Volts.	Watts.	Dols.	Dols.
1	.0086	.0335	.0362	7.24	1,448	144.80	700.00
2	.0086	.0671	.0586	11.72	2,344	234.40	700.00
3	.0086	.0796	.0882	17.64	3,528	352.80	90.00
4	.0086	.0898	.0484	9.68	1,936	193.60	180.00
5	.0086	.0133	.0218	4.36	872	87.20	180.00
6	.0086	.0044	.0130	2.60	520	52.00	115.00
7	.0086	.0105	.0191	3.82	764	76.40	200.00
8	.0086	.0035	.0121	2.42	484	48.40	130.00
9	.0086	.0033	.0169	3.38	676	67.60	220.00
10	.0086	.0027	.0113	2.26	452	45.20	150.00
11	.0067	.0335	.0306	6.12	1,224	122.40	1,250.00
12	.0067	.0016	.0078	1.56	312	31.20	432.00

Of course, in localities favored all the year round with wet ground, the above table would be seriously astray; but, as I have said, the table is based upon the most unfavorable condition, namely, earth frozen hard for two or three feet deep, and earth conductivity practically *nil*.

I must not take up your time with any extensive analysis of Table III, but I cannot forbear pointing out a few striking features. Take cases No. 2 and 6. The former is, no doubt, used by many members of this Association. No. 6 is the system of track circuit of the Atlantic Railroad, in Brooklyn, N. Y. No. 2 has a total track resistance of .0586 ohm and costs, for material, about $700 per mile, while No. 6 has a total track resistance of but .0130 ohm, and costs, for material, only $144 per mile. In other words, No. 6 in point of efficiency, is four and a half times a better electric circuit than No. 2, while costing just about one-fifth as much. In roads likely to have extreme heavy traffic, case No. 11 has been adopted, there being four No. 0 supplementary copper wires and the ordinary copper rail bonds or connectors; being thus merely an enlargement of No. 2, and used in connection with ninety pound rails. In case No. 12, the ninety pound rails are also used, but there are no supplementary wires, and each joint of the rails is supplied with two rail bonds of No. 0000 copper wire each only twelve inches long. Comparing results, it is evident that case No. 12 is, electrically, about four times a better circuit than No. 11, while costing only about one-third as much.

Now let us compare case No. 12, as it stands, with case No. 11, but adding to the latter two 500,000 circular mils overhead returns connected heavily to the track circuit at frequent intervals. In case No. 12 the total track circuit resistance is .0306 ohm; that of the two 500,000 circular mils feeders about .0545 ohm; and the combination circuit measures about .0196 ohm. The cost of the two feeders (insulated) per mile of double track roads would be approximately $2,800, to which we add the $1,250, cost of track circuit in case 11, making $4,050.

In short, though our case No. 12 gives us almost three times as efficient an electric circuit as the new case No. 11, the latter costs almost ten times more than No. 12. And yet the West End and Brooklyn City Railroad companies pin their faith in a circuit like case No. 11.

A glance at the sixth and seventh columns at Table III is rather instructive. If we take a medium city system operating twenty miles of double track, the company which uses case No. 2 will pay several thousand dollars per year for the energy wasted in the return circuit, while the company using No. 6, or No. 8 or No. 10, will pay but a trifle in comparison, and save nickels by the quart. I am of the opinion that it would, to-day, well repay any company using copper supplementary wire to rebond its tracks on a basis of perennial low resistance, because on the average it would save the cost of such change in one year. And I say the same to those using iron rail bonds.

If it be admitted then, that it is desirable to obtain from the track structure as great a conducting power as possible, the question arises, How shall it be done? This at once brings us to the subject of rail bonds, and a criticism of the various types used, with a view of arriving at the best from all points of view.

There have not been many types brought out by the manufacturers. Probably the earliest was made of a piece wire having its ends coiled around two rivets and dipped in solder. This form is still much used, but it is objectionable. By its use four contacts exist at every rail joint, *i. e.*, rail to rivet, rivet to wire, wire to rivet and rivet to rail. To insure its position in the rail the rivet must be upset, and this in a great number of cases either starts or completely loosens the contact between the rivet and wire. If it escapes this, the constant vibration of the rail sooner or later causes loosening of the wire on the rivet. Once looseness occurs, the bond is of little use. Again, the essential nature of such a rail bond precludes the use of any large wire in its construction. Still, many roads have used them and are still doing so. The wire generally used is No 4 B. & S., sometimes iron and sometimes copper.

Another type, which has met with much favor, consists of two soft iron pins with enlarged heads, which are drilled transversely to receive the connecting wire which is upset after passing through the heads. This form is open to the same objections as the previous one, being in three pieces, the integrity of whose contact is almost sure sooner or later to be destroyed, whether the intermediate wire is iron or copper.

Later on appeared the ingenious and, from a purely constructive aspect, very economical channel pin. It met an enormous sale, and it is to-day in extensive use. The form is familiar to you, and I need not describe it. It requires three pieces; is not capable of riveting in the rail, and its form prevents the pin and wire from completely filling the hole in the rail, and rapid corrosion of contact is inevitable. Being merely driven wedge-like into the rail hole its stay is not reliable, and by corrosion and continual vibration it becomes loose and almost valueless. There is, too, a tendency for the workman to force the wire against the sharp edge of the hole while driving the pin, thus weakening the wire very materially. It too, like the rivet-and-wire bond, has a limitation as to the size of the connecting wire. No matter how carefully the mechanics of the job are attended to, we have a mere plug driven in a hole, and so between the rail and channel pin and the car wheels is a very good illustration of a cask, a bung and a bung starter, with the odds against the bung.

Another type of rail bond is that composed of a piece of copper wire with cast copper rivets electrically welded thereto on projecting stems the size of the wire. This is an attempt in the right direction, but does not work out in practice. The electric weld is apparently uncertain, the union in many cases under my inspection being so imperfect that it could be broken by hand. The small copper castings exhibit radial crystallization, making welding difficult. Many also break in applying to the rails, and such happenings destroy confidence.

I now come to what is known as the "solid one piece bond," which has sprung into great favor. It would be disingenuous, were I not to announce right here, that this rail bond is a patented invention of my own, but I hope that you will admit that I am trying to view this question from a broad and disinterested standpoint.

This solid, one-piece rail bond is simplicity itself. It is merely a wire with expansion curves at its ends on each of which a heavy shoulder is swaged from the wire itself, so that both the rivet ends thus formed and the intermediate wire are all one solid integral piece. From rivet to rivet there can be no failure of contact, except by forcible rupture or total corrosion, and there can be no failure of contact between bond and rail, because when the rivet end is properly headed up, the connection made is perfectly watertight and airtight, and it is proof against pounding and vibration. There is no solder required, no parts to shake loose, and there is no restriction in size of wire, as the bond can be made of No. 4 wire, and it can be made of No. 0000, and larger if desired.

I suppose the great majority of rail bonds used span around the fishplates, which nowadays are quite long. My belief is this is a mistake. Table III will show what a difference there is in resistance in the track circuit as between thirty six inch and twelve inch bonds. The twelve inch bond has the advantage in the total track resistance of from 40 per cent to 50 per cent. A twelve inch solid bond, with its expansion curves, makes a distance between rivet centers of about eight inches. Electrically considered, it does not matter what part of the rail end is used for bonding. The holes can be drilled through the flat "tram" or through the floor of the rail, four inches from the end, just as readily as through the web or stem. There is no difficulty whatever, and I can imagine no type of track construction forbidding the use of short bonds. I have bonded many miles of track in this manner, and used the twelve inch bonds, and had no trouble. In girder rail I prefer to drill the holes through the flat tram, taper ream the holes from above, and deeply countersink; then pass the rail bond up from beneath, and head up the ends till the taper and countersink are completely filled. This method has one great advantage, in allowing every rail bond to be inspected at any time without disturbing the paving. The tracks of the Atlantic Avenue Railroad, in Brooklyn, were bonded in this way with No. 000 copper bonds, eight inches long between rivet centers, and they have given entire satisfaction.

Rail bonds should, after being applied, be either heavily coated with shellac and asphaltum, as practiced by Mr. Wason in Cleveland, or have a grooved strip of wood filled with asphaltum slipped around while the compound is soft. This will prevent corrosion.

Another important element of the return circuit, in such roads as do not pass the power house, is the main return. Whether earth circuit is used or not, there should be a heavy connection from the generator or switchboard by the shortest route to the rails. Such a course is generally adopted, but the size of the conductor is apt to be too small. I have seen several cases of serious inadequacy in this direction, so much, indeed, as to heat the main return. I had occasion once to discuss the question with a gentleman who called himself an electrical engineer, and who had engineered several railways of considerable size. The problem was to return a possible maximum of 5,000 amperes about half a mile from tracks to generator. I gave my views, which embodied rather heavy work, and also my calculations for loss of energy, etc. "Nonsense," said he, "four No. 0000 wires would be abundance, because you can lay them in the ground, and the heat will be carried off before harm can be done." It was no use arguing against that; and I utterly failed to persuade him that his four wires would require 320 volts to drive the 5,000 amperes through them, *i. e.*, a loss of over 2,100 E. H. P. Fortunately, that engineer has generally had some check on him, and thus the construction of several monstrosities has been avoided.

The old rails can be made advantageously used for the main return in many cases. When it comes to using a large number of heavy copper wires overhead or underground on the one hand, and on the other hand an equivalent capacity of old rails laid underground, the latter is much cheaper, and can be made entirely durable. The rails can be connected by heavy copper plates by riveting, the number of rivets being equal in carrying capacity to that of the rail and plate. The whole structure can be laid in a wooden trough filled with pitch, and will remain intact for an indefinite period. A one-rail line of this kind, composed of old sixty pound flat or center bearing rail, is as good as a copper bar one inch square, or six No. 0000 copper wires.

I am, therefore, led to the conclusion that the best return circuit is that which complies with the following requirements:

1. Intrinsic resistance low enough to need no help from earth.
2. Utilization, to the utmost practical extent, of the rails as the return conductors.
3. Rail bonds of the heaviest practicable size.
4. Rail bonds of the shortest possible length, consistent with due allowance for expansion and vibration.
5. Rail bonds made of a single piece of wire with integral rivets.
6. Rail bonds tightly riveted to the rails through holes freshly reamed immediately before bonding.
7. Rail bonds so placed as to permit convenient inspection.
8. Rail bonds protected against corrosion.
9. A very liberal use of heavy cross bonds from rail to rail direct, and, in double track, extra heavy cross bonds connecting the two inside rails.
10. An underground main or trunk return from power house to track, and there connected to each line of rails, and low enough in resistance to carry the maximum current with but a nominal drop in potential.

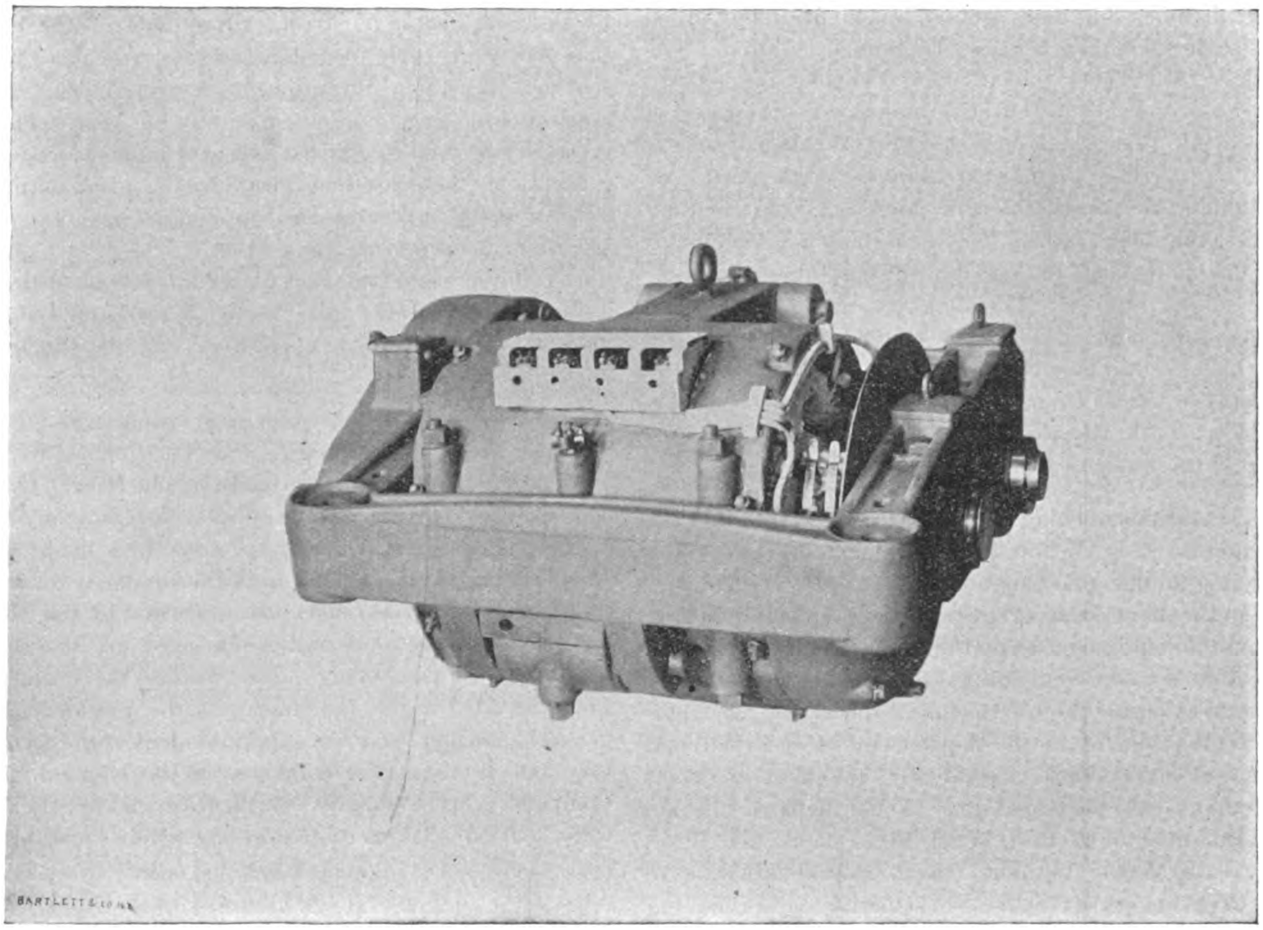
Not one of these requirements is an extravagance, but, on the contrary, their proper application to almost any electric railway in the country would be of immediate and lasting benefit. In new constructions they would be a positive economy in first cost. There is not one of them which cannot be adopted in practice, and it seems obvious that their complete embodiment in any existing road would be immediately noticeable in the power house, and eventually in the dividend.

The fire on September 13th in the Corcoran building in which are located the offices of the Western Union Telegraph Co. at Washington, D. C., cut out over 400 wires. A fire in a telephone station or telegraph office can destroy in a very short time thousands of dollars worth of valuable property. If the fire itself does not do the damage the water used in extinguishing the fire accomplishes the ruin.

Duquesne Lines of Pittsburgh.

There are few electric street railways in this country of more interest to the street railway men, than the Duquesne Traction Company's lines of Pittsburgh. This road has not only an interesting history, albeit a comparatively short one, but it also presents a number of other features, which are of interest.

The Duquesne Traction Company controls a large number of the best routes of street railway travel in the City of Smoke, and yet the Duquesne Traction Company was organized less than five years ago. It was soon after the operation of street cars by electricity had become an established success, that a number of the most influential and enterprising of Pittsburgh's citizens, realizing that the city was in great want of rapid transit, evolved the project for the roads. Hon. C. L. Magee was one of these gentlemen. The plans were laid out, councils were asked to accord them the privilege of occupying the streets and work was at once commenced.


DUQUESNE LINES OF PITTSBURGH—THE ELECTRIC MOTOR.

Progress was made so rapidly, that in less than a year from the day the plans were first spoken of, Pittsburgh was enriched by one of the finest electric roads in the country, and nearly forty miles of streets were covered with tracks, affording thousands of citizens the opportunity of rapid transit where they had hitherto been obliged to walk or depend upon a distant steam railroad. Of course the whole thing was done in a hurry and owing to this it was but natural that mistakes would be made somewhere. One of these showed itself in the selection of the motor equipment. In the hurry of deciding as to what motor would be the best, the Duquesne company selected a type which was unfitted for the operation of the road. In this connection it might be mentioned that all the routes traverse a very hilly portion of the city, there being in the whole forty miles of track not a single mile without a grade varying in steepness from five to seven per cent.

In fact there is one long hill of a seven per cent grade over half a mile long. For this work the original motor equipment was totally unsuitable, and the trouble the company had during the first year of the operation of its sixty-eight cars was something enormous. There was scarcely a minute during the day when the repair shop was not crowded with defective motors, and the cost for repairs during that period was enormous and precluding the possibility of any financial success. It was obvious that this condition of affairs had to be changed. The road had been projected and constructed to be profitable and to earn interest on the investment. There seemed to be only one means of redress, and that was to change the motor equipment.

The company had not long to search for what they wanted. Fortunately the Westinghouse single reduction motor had been put on the market in the meantime. The Duquesne company contracted with the Westinghouse company for the entire equipment of their cars, one hundred and twenty-eight single reduction motors. The change was completed by the first of February last, and since then the road has been running without any interruption, nor has there ever been a minute lost on account of a defect in the motor.

By a traffic arrangement entered into between the Duquesne Traction Company and the Pittsburgh Traction Company, the latter is now in control of the operation of the Duquesne lines. Col. G. W. Elkins, ably assisted by his son, W. L. Elkins, has charge of the entire road, and today the Duquesne Traction Company has a system of street car lines with no superior and few equals in this country.

Electrical Industries.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

The most serious street railway accident of the month occurred on the electric railway between Cincinnati and Avondale September 3d. One person was immediately killed and a score were more or less dangerously injured. The Avondale road where the accident occurred has a down grade for over a mile. Defective brakes were the cause of the accident. The train consisted of two cars and uncontrolled on this down grade soon attained a high speed. After jumping the track the cars struck a large telegraph pole breaking it in pieces. The motorman and conductor being unable to check the speed of the cars jumped and received slight injuries. The majority of the passengers were less fortunate. The need of better brakes for electric cars which are run on steeper grades and at higher speeds is forcibly apparent from the number of accidents of this character. Both the safety of the passengers and the protection of the traffic of the street demand it.

The auspicious opening of the Armour Institute and the large number of applicants for admission must have been gratifying to the generous founder, Mr. P. D. Armour. With an excellent corps of instructors, a splendid endowment and an equipment second to none it may well look forward to a successful future, and it will undoubtedly soon rank as one of the best technical schools of the country. Its equipment in the department of electrical and mechanical engineering is especially fine both in extent and quality of the apparatus. These departments are under the direction of Prof. W. M. Stine, M. S., and Prof. E. W. Cook, M. E. While it devotes special attention to these departments its field of instruction covers mining engineering and metallurgy, architecture, domestic arts and sciences, commerce and normal kindergarten. A course of civil engineering is to be added. The plan in every department is to combine the highest scientific knowledge with thorough practical training. Dr. Gunsaulus had set the number of students to be admitted the first year at 500, but on opening day 1,200 students of both sexes presented themselves.

One of the advantages of the incandescent lamp, to which its general use is in a measure indebted, is the little attention required in keeping it in order. A lamp replaced at intervals is all that is required while in the case of the ordinary arc lamp the carbons must be replaced at least once each day. The cost of carbons and trimming is no inconsiderable part of the expenses of the central station. The new 100 hour arc lamp invented by Mr. L. B. Marks and described by him in his paper before the International Electrical Congress would seem to require little attention in comparison with the ordinary lamp. The slight, if any, loss of efficiency will be more than made up by the difference in the light secured. Mr. Marks is a young man but 25 years of age but he has spent almost his entire time in experimenting with and in the manufacture of arc light carbons, and the results of his experiments as set forth in his paper before the congress has brought him immediately into prominence.

Nothing has done more to advance the interests of street railways and to bring it to its present state of perfection than the frequent conventions of street railway men. National conventions, affording an opportunity for an exchange of experiences and the discussion of new ideas, have been held annually under the direction of the American Street Railway Association for a number of years. Several states have also state associations with the same object in view, that is of advancing this industry. These conventions have been so largely attended and supported by the representative street railway men of the country that they were early recognized as the best place to present new ideas, new inventions or improved machines and apparatus relating to the street railway business. This fact gradually became recognized and at a number of the later conventions the exhibitions made by the manufacturers of street railway apparatus and appliances have become an important feature of the convention. The greater preparations being made for this part of the attractions at the coming convention at Milwaukee would indicate that the exhibits of street railway apparatus will be many and important.

On September 4th the first case called in the Quarter Sessions Court, at Pittsburgh, was the Commonweath vs. William J. Clark, Milton H. Hamilton and Morris W. Mead. This is the sensational blue print conspiracy case which caused a considerable surprise when first made public. The Westinghouse company from the similarity of many of the plans for proposed machines submitted by the General Electric Company to its own, commenced an investigation that led to the facts being placed before the grand jury, which resulted in the indictment of the president, of the general manager and the superintendent at the Lynn factory and a number of employes of the General Electric Company. Mr. Coffin, Mr. E. W. Rice and W. H. Knight were not on trial as they were not within the state. Mr. H. F. Ashton, a draughtsman testified at this trial that from July, 1892, to January, 1893, he was in the employ of the Westinghouse company, and that from September to January of that time he was also employed by Morris Mead and W. J. Clark of the General Electric Company. He gave an account of the manner in which he used his position to enlighten the officers of the General company regarding the affairs of his employers for a consideration of some $2,000. The defendants were represented by quite an array of legal talent, and the district attorney was assisted by members of the New York and Pittsburg bars. On the second day of the trial Lawyer Patterson produced letters and telegrams that passed between the accused parties. Ashton also described the code used in the communication. Frank Carey and Charles E. Christian told of receiving money for blue prints. The witnesses for the defense denied the testimony of these witnesses, and testified to the good character of the defendants. The case was given to the jury on the 8th, who, after twelve hours' deliberation announced their inability to agree on a verdict and they were dismissed.

The Chicago Electric Club.

After its long struggle for an existence, the Chicago Electric Club is about to be a thing of the past. This, however, is but the inevitable result that the majority of its members foresaw long ago. A few of its organizers have made great efforts to keep the club alive, but as the electrical fraternity could not be made to see that they were getting any benefit from a club run in the way that it was, it has naturally come to an end. Dues have been paid by many who have done so from pride and pure public spiritedness, but today the club is with heavy bills to be paid and a treasury without funds to meet its obligations.

The failure of the Chicago Electric Club is a matter greatly to be regretted, but it was not necessary for anyone to be a prophet in order to foretell the end. In justice, however, to the present management, it should be said that it is not to be held responsible for this failure. The present officers and managers have done the best they could, but its fate was sealed long before they came into office, and nothing could save it.

Storage Battery Decision.

On September 21 a decision was rendered by Judge Colt at Boston in favor of the plaintiffs in the injunction suit brought by the Consolidated Storage Battery Co. through the Brush Electric Co. against the Milford & Hopedale Street Railway Company. Judge Colt stated in his opinion the Brush patents had been sustained by the courts in several cases, and that the question in this case was whether the defendant's battery was within the Brush patents.

The patent in suit was for the broad invention. This consists of a secondary battery electrode in which the active material is mechanically applied to a supporting plate. The Brush patent is easily understood. There is first the supporting plate, secondly the active material mechanically applied, and thirdly the active material held to the plate by pressure or by a sheet of porous non-conducting material. It is the combination of these elements in the formation of a secondary battery which is covered by the patent in suit, and by this means Brush produced the first commercial storage battery.

The Usher battery used by the defendants consists of a plate in the form of a rectangular grid with vertical and horizontal ribs. Enclosed and held between the ribs are packages of active material in the form of powdered oxide of lead, commercially known as red lead, having a wrapping of thin sheet lead. The wrappings are perforated and filled with gum. Thin sheets of kiln dried wood separate the plates. The plates and sheets are held together by rubber bands, and are set in a receptacle of hard rubber containing dilute sulphuric acid. In structure certainly this battery appears to have the elements of the Brush invention, a supporting plate combined with mechanically applied active material, the plates being separated by sheets of porous non-conducting material.

The case is then discussed by Judge Colt, who in conclusion says: The answer to this is that when the defendants take a quantity of finely divided oxide of lead such as Plante produced by the disintegration of the plate, and which is known and understood in the art as active material, and apply it directly to the supporting plates to form the electrode of a secondary battery, they have appropriated the invention of Brush, and it is useless for the purposes of this case to make any further inquiry. But it is significant in this connection that Usher in his two patents for improved storage batteries, introduced in evidence by plaintiffs, calls the oxide of lead contained in his packages active material. The only difference in this particular between Usher and Brush is that the former encloses his active material in perforated lead wrappings.

Charles E. Scribner's Arc Lamp Patent Sustained.

The Western Electric Company, some three years and a half ago, brought suit against the Sperry Electric Company for infringement of Patent No. 420,109, of January 28, 1890. The application for the Scribner patent was pending in the Patent Office for more than seven years, and Judge Gresham in the court below held that the application had been abandoned in the Patent Office. The Circuit Court of Appeals of the seventh circuit on October 2, 1893, reversed this finding of Judge Gresham in an able decision, which is too long for us to publish in full.

It appears that Scribner was the first to invent a swinging or movable frame supporting the coarse wire magnet; that is the lifting magnet of an arc lamp, which frame was adapted to be controlled by the fine wire magnet placed in the shunt around the arc, thus controlling the feeding of the carbons by controlling the movement of the frame and thereby the clutch.

The defendant, Sperry Electric Company, manufactured the lamp which was held to be an infringement, under letters patent No. 405,440, to Elmer A. Sperry, of June 18, 1889, which had been applied for and issued while the application for the Scribner patent was pending in the Patent Office. This Sperry lamp contained the same combination of parts found in the Scribner patent, but quite differently arranged.

Barton & Brown appeared for Western Electric Company; Francis W. Parker appeared for Sperry Electric Company.

Judge Woods, speaking for the court, says: "There is a material difference between the abandonment of an invention and the abandonment of an application for letters patent thereon by failure to comply with Section 4,894 of the Revised Statutes. The first gives the invention to the public, and once done the act is irretrievable; but, besides the power conferred upon the Commissioner of Patents to relieve an applicant from an abandonment of his application under the statute, an application which has lapsed or been rejected or withdrawn, may be renewed or repeated so long, we suppose, as the invention itself has not been abandoned by reason of a two years' public use or otherwise."

After reviewing authorities at length, the court says: "Guided as we must be by these decisions, we are not able to find in the present case an abandonment either of the invention or of the application for the patent." In conclusion, the judge says: "The first claim of the Sperry patent, and other claims not quoted, are essentially the same as the first and second claims of the patent in suit, and the lamp made by the respondents differs in essential elements from the complainant's lamp, only in respect to the relative positions of the main-circuit magnet and its armature, horizontal parts being made vertical, and vice versa.

"Our conclusion, therefore, is that the patent in suit is valid, that it belongs to the complainant as assignee of the patentee, and that the respondents before suit had infringed the first and second claims thereof as charged."

The Large Generator at the Intramural Power Plant.

The traffic on the Columbian Intramural Railway has greatly increased and at certain times of the day the cars are now crowded. It affords not only a most convenient way of seeing the Exposition grounds, but the method of transportation is to many novel, being the first complete road of its kind in America. In the June issue of Electrical Industries appeared a description of this railway which was then nearing completion but owing to the huge generator, which is now the center of attraction at the power plant, being but partly completed it was impossible to give a complete description of it at that time.

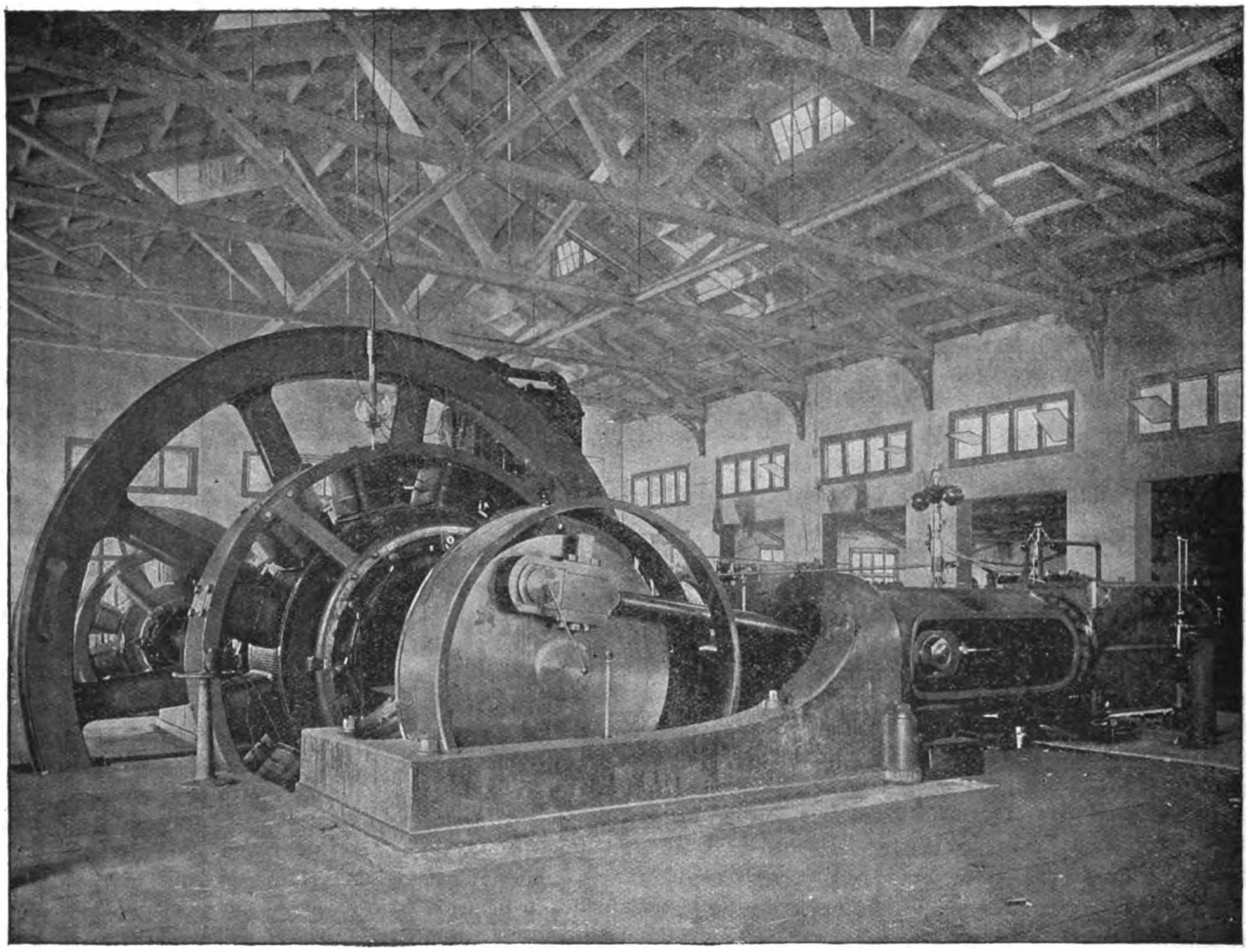

FIG. 1.—THE LARGE GENERATOR AT THE INTRAMURAL POWER PLANT.

This generator which is located near the center of the power plant is rated at 1,500 k. w. It is coupled direct to a 2,400-horse power Allis Corliss engine, making the largest combination erected. Its tremendous size precluded the possibility of its shipment complete to the Fair. The different parts were, therefore, shipped separately from the General Electrical Co.'s works, and were put together for the first time in the power house itself. Some idea of the size and weight of this dynamo may be gathered from the following table of weights and dimensions:

Weight of field magnates, 80,000 pounds; weight of armature, 73,600 pounds; weight of commutator 12,400 pounds; weight of dynamo, complete, 181,000 pounds; weight of shaft and hub, 56 tons; weight of fly wheel, 85 tons; diameter of generator, 15 feet, ¼ inch; breadth of generator, 3 feet; diameter of armature, 10 feet, 6 inches; breadth of armature, 3 feet, 3¼ inches; diameter of fly wheel, 24 feet; breadth of fly wheel, 2 feet; thickness of rim of fly wheel, 1 foot, 10 inches; diameter of commutator, 7 feet, 6 inches; diameter of shaft, 2 feet.

The machine has twelve poles, is compound wound, and is carefully insulated from the ground. The air space between the faces of the poles and the face of the armature is 7-16 of an inch.

The armature is built up of sheet iron punchings set around a spider shrunk on the hub. This outer face of the spider is slotted as are the inner faces of the armature punchings, so that they dovetail together. Each circle of sheet iron is carefully insulated from the preceding one except at one point, and this results in giving to the armature a spiral construction. Not less than 17,200 pieces of sheet iron weighing 25 tons, were used to build up the nine sheet iron sections, separated from each other by eight brass open rings, resembling spoked wheels, which serve for ventilating purposes. Two 4-ton cast iron washers held together by bolts complete the material composing the armature core.

The winding of the the armature consists of copper strips 3¼ inch wide by ¼ inch thick, two turns to the coil. These are carefully insulated from each other by mica, and each couple is inserted into one of the 348 slots in the laminated armature body each of which is itself lined with a mica tube. The strips are held in place by means of a wooden wedge. The side connections are then riveted and soldered to the strips and are brought down to the massive copper commutator. There are twelve brushes, which are manipulated by means of a hand wheel actuating a gearing concealed beneath the floor of the power house.

The engine is a cross compound Reynolds Corliss, constructed by E. P. Allis & Co., of Milwaukee, and has a capacity of 2,400-horse power. Its two cylinders are set on each side back of the generator, the high pressure cylinder having 32 inches diameter and the low pressure 62 inches. Each crank disc is seven feet four inches in diameter, one at each end of the shaft, and the length of the stroke is five feet. The fly wheel wheel is built up in ten sections, bolted together by dumb bell shaped pieces. It is clutched to the shaft by a special clutch.

The electrical equipment of the road is in every way of interest, not only to electrical and railway engineers, but also to the public, who are interested in every improvement in the direction of better facilities for transportation in great cities. In the case of the Intramural Railway, the public is invited to visit the power house, and to request information upon all they see in connection with the operation of the road. The interest of the public in the advancement made in electric traction is shown by the large number of visitors daily to this power house.

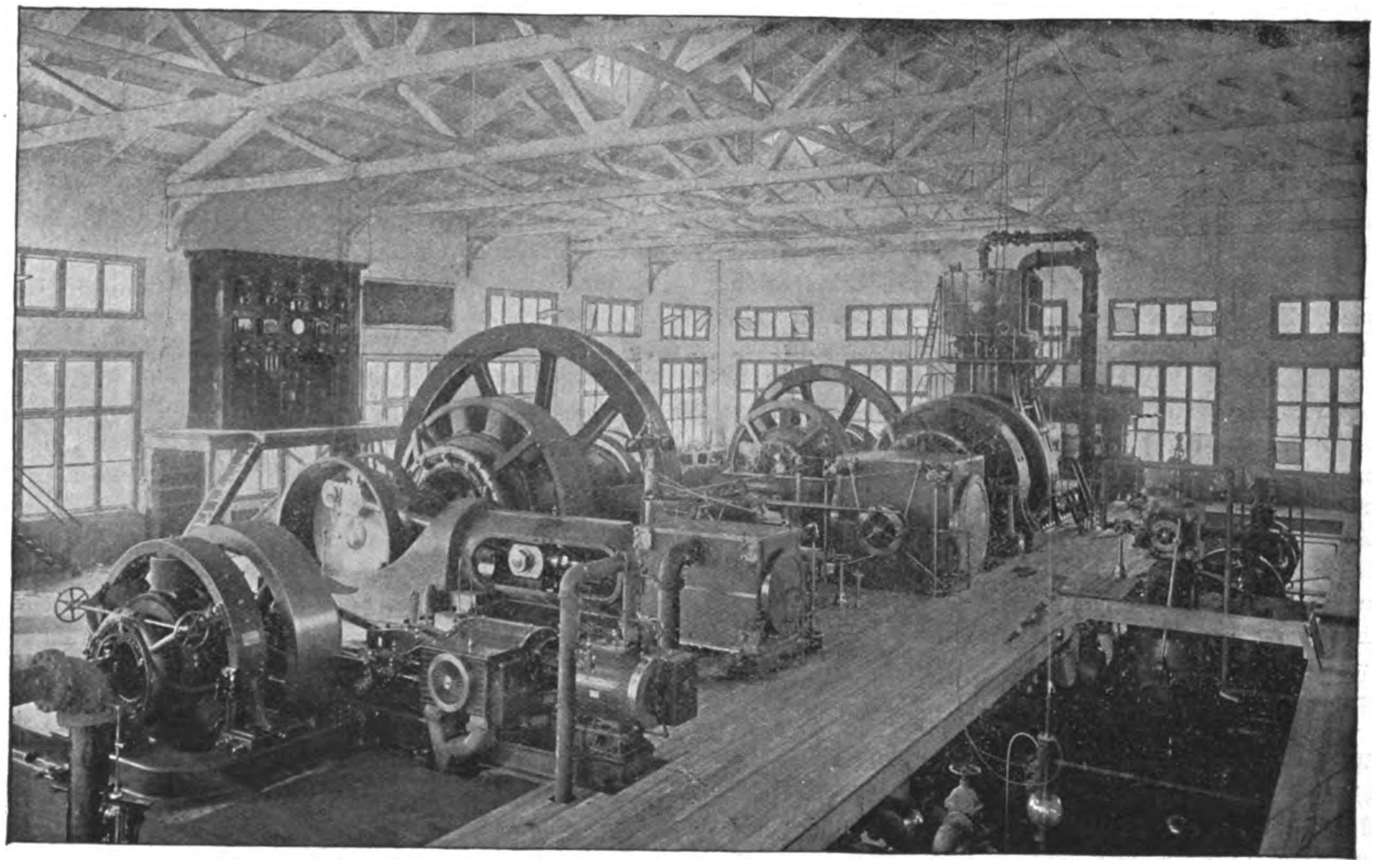

FIG. 2.—THE LARGE GENERATOR AT THE INTRAMURAL POWER PLANT.

The excessive and numerous grades and curves render the test of electrical machinery one of considerable severity. There is probably no elevated railroad in the world which has so many curves and grades as the exigences of construction at the Fair has given to the route which this follows.

The Interior Conduit & Isulation Co., of New York, means to defend its position that it owns and controls the conduit system of wiring. It has brought suit against Carpenter & Tremaine, contractors for the wiring of the new City Hall at Brocton, Mass., who were using vulcaduct. It is also stated that the attorneys of the company are about to proceed against other users of alleged infringing tubing.

The Business End of Electricity.*

BY H. C. THOM.

It is neither the scope nor the purpose of this paper to discuss the technical details of the business. These must be met by the struggling managers and bewildered directors in their own way, because local conditions vary so radically. With your permission, such matters will be touched as are generic to all plants. You may not agree with opinions submitted. In truth; I trust you will not. The best good always comes from an informal discussion. If I am unable to defend my positions, I will try your plan next month.

In the organization of a corporation, be sure it is legally formed. Don't go at it by guess. Let some one who has experience do it for you. This kind of service comes cheaper than litigation. Corporations are not created for the day, and are never established on a silver basis. Fix upon the capital stock. Have it large enough and pay it all in. Do business. Discount every bill. Buy close and you can make your salaries out of your methods. Do not bond or borrow if you can see a way out. Bills payable are an abomination in the sight of a stockholder. In building a plant, keep one eye on your bank balance and the other on the future. If you render good service, extensions will come as sure as short circuits. Don't carry a dead weight in machinery, but when the time comes, have boiler, engine and dynamo room.

When the organization is perfected, the stock paid in, the ground purchased, and specifications accepted, we are then ready to install machinery and buy supplies. Please take me by the hand and we will walk down to the county court house in order that we may make court record of formal proceedings for divorce from any particular electrical supply company. You must give up the young man who knows all about everything, but is dead sure of two things—your business and the fact that he handles the only supplies that are worth putting on a foundation or hanging on a line. The field is large you know, and we are about to walk alone. Let us be careful; let us talk the matter over with the other fellow, demand a guaranty that will stick, and when we are satisfied that we are getting the best, cheapest, trade. Every metropolis has a supply house. Most of them are backed by representative men and as competition grows, prices cheapen and standard goods only must be turned out to hold the ear of men who walk alone. It is false economy to buy anything but the best. It may do for the time, but the time soon comes when you endeavor to forget your natal day.

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* Abstract of paper read before the Northwestern Electrical Association at Madison, Wis., July 19th, 1893, by Mr. H. C. Thom, Secretary and Manager of the Four Lakes Light & Power Company, Madison, Wis.

The next question is one of labor, skilled and otherwise. Boys should be in school. A good way to arrange the old precept is that good hire is worthy labor. Engage a man at such wages that you can replace him in twenty-four hours at the same pay. If you cannot get a man in his place for the same money, you are not paying enough. If you can get as good service for less, you are paying too much. If you stand on this rock, no union will dictate, no strike will annoy, and the loud-mouthed agitator will meet a cool reception in your town.

When outside operations are begun, we have occasion to look more closely at the franchise. If your station is the only one and you erect the first pole in town, little trouble ensues. Every man is your friend. You can stick a pole in front of everybody's big window, or connect with the favorite shade tree of every retired farmer on Quality street. Every one gives a nod and an encouraging smile. One man says: "Private enterprise is good. I like to help such things along; looks metropolitan, no city tax, see?" "Why don't you fasten that guy wire to the corner of my barn? There, that's all right—cheaper than to set a pole. Needn't thank me, sir, I am only too glad to help the thing along." Your heart swells with love for the human race. How can men be so narrow as to say that the average man is selfish? Down with such carping. All one has to do is to treat everybody alike, to be decent and one can make friends everywhere.

Wait, my dear boy. Wait until you get $40,000 into the station. Wait until you set a thousand poles at $7.00 each and string wires until God's blue sky looks like a weaver's loom. Wait until the city shines like the realm of glory. Wait until you invest notes and bonds that have taken years of patient toil and economy to accumulate. Wait until you get $100,000 in giddy smoke stacks and puffing engines, bolted to solid rock. Wait until you have taken the shapely cedar from northern Michigan and stuck in six feet of mud at your own door. Wait until the Daily Chronicle comes out in big headlines and says that the station is a marvel of human ingenuity and systematic arrangement, that the service is perfect, and compares it to that of St. Louis; and further states that the city is very fortunate to have men that are public spirited enough to invest their money in such a semi-public enterprise; that we have a model manager whose sole aim is to serve the city and patrons upon the line. Then your heart is filled with glory, and you know now that if you are stricken, the verdict of all men will be—"Well done, thou good and faithful servant." Wait a little longer. Wait until some patron discovers that in a city by a big river they get an arc light until twelve o'clock for $5 a month, and your bliss is a dream. Within a day this same patron discovers that "the meter is a fraud; manufactured under contract to register twice the current used." A councilman has been seen by an ambitious supply house, and the dance begins. The panic spreads; The Chronicle catches it, and to your untold horror, you discover that the city editor knows more about the expense of running your plant than the whole station force together, though how they can keep such a man on the staff at $6.00 a week forever remains a mystery.

A franchise for a light plant is not a very valuable document. In my judgment, an exclusive franchise is unconstitutional and if it is, the field is open to all comers, and this being the situation, you are simply accorded the privilege of doing business in the town and swelling the assessment roll. A shoemaker or a plough factory can do the same, often assisted by a good bonus. When the importance of electric illumination is once understood by municipalities, no doubt instances will be numerous when large appropriations will be made by common councils to help struggling corporations pay five per cent dividends. Indeed a franchise is often but the medium through which the city can use valuable property of the company without rental, or it may contain authority vested in the council to grant the use of valuable company property to competitive corporations at a nominal rental. A railway franchise may have greater commercial value from the necessity of the situation. Two lines upon the business streets would not be tolerated by the citizens.

The question of wiring is a difficult one. Shall the company do wiring gratis? Shall the company do incandescent wiring gratis? Shall the company do all wiring gratis? Shall the company wire at all? It is easy to understand conditions that would compel a company to answer in the affirmative all of the above questions. If I were starting a new plant, I would not wire at all. If a customer pays for wiring, he then has an interest in the plant. He is less likely to be fickle in his patronage. If it is done by experts, engaged by the customer, a heavy burden is taken from the company. On the other hand, the system of free wiring may have been inaugurated before the purchase of the plant: Then it is indeed difficult to change. Lamps for residences and lamp renewals for residence and commercial circuits raise the same line of questions. Conditions will force you to meet these issues as best you may. Whoever wires, have it done in such a way that it will stand rigid inspection. I have labored to bring about a system whereby an inspector appointed and maintained by an insurance board of under-writers should make semi-annual inspection. Let him examine, accept, or condemn and report. No one has howled about wires longer or louder than insuranceites.

No business requiring capital and brains ever succeeded without application to details. Corporative concerns are much to blame and in a large measure responsible for the attitude towards them by the people and municipalities. We owe it to the tax payers and to the city as well as to ourselves to so administer our affairs that good service can be rendered at reasonable rates. The public knows more about electricity that isn't so than of any other commodity. We cannot and ought not to expect the public to always know the truth. It is only a little while since the wizard hung a lamp in Menlo park and made the astounding statement that it would not go out before morning. We should not hold the people to quick conversion. The electric field is so vast and so fertile that the whole scientific world has devoted all its power to general knowledge, without stopping to intensify processes. The result has been lack of economy in production and continual changes in machinery and apparatus, thus entailing heavy losses which corporations have added to expense account, therefore making room for charges of extortion by the customer. My friends, the only way to set at rest forever, complaint, criticism and rebellion against rates is to set our house in order, sweep up every item of unnecessary expenditure, bridle the current and drive it in its proper channel until its mission is fulfilled. Establish a fair business per centum for your investment and then go straight ahead. Do not let Mr. B., the doctor, or Mr. C., the lawyer, conduct your affairs or vary your schedule. Treat them as fairly as you do the council, no better, no worse. If necessary, go before this body with your books, let them see that you are only getting a fair return for money invested and a just per cent for depreciation of plant. Every tradesman, every factory and every corporation is justly entitled to this at the hands of all honest men who consume the product. If these methods are pursued and your customer kicks and the city still finds fault, they will never be satisfied until generators are run by the grace of God and the countershaft is belted to the bolt of Jove. Then we can say: "Let there be motion and there is motion, with cost." When this millennium comes, trolleys will hang over the mighty Mississippi and the picturesque Hudson; the traveller can lounge from the window of the lightning railway car, while telegraph poles shrink to fine-tooth combs as we rush through the air, and the mile-stones which dot the rolling prairies shall group themselves so that they resemble the populous cemeteries of the sunny south.

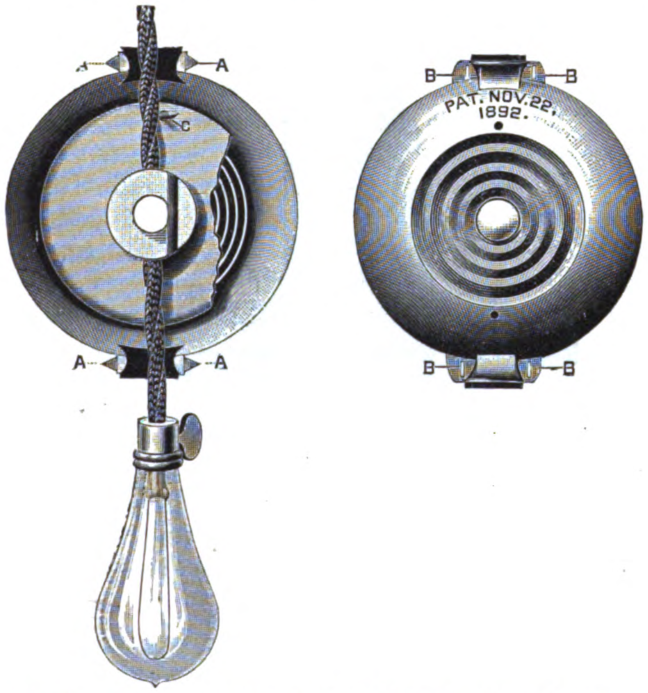


FIG. 1.—PORTER'S PATENT ADJUSTER FOR ELECTRIC LIGHTS.

A new specia of the genus, electric faker, has been discovered by a London contemporary in the shape of an electric horse doctor. The gullibility of mankind would appear greater were it not that the calling was so unprofitable as to cause the individual to steal his mother's jewels by which act he became known to the public. We are not informed as to the manner in which the electricity is applied, whether in an electric plaster, a belt or curry-comb but have no doubt it would be equally efficient in the cure of spavins, corns or of the glanders in whatever manner applied.

Porter's Patent Adjuster for Electric Lights.

The demand for a simple and efficient electric light adjuster has long been felt, one that can be quickly and easily attached, and at so small expense that no one can afford to be without them; with this adjuster the light may be instantly adjusted to any position within its range and held firmly without wear to the cord.

This adjuster can be attached in one minute without detaching the cord from lamp socket or roset, this being a new feature in electric light adjusters, and one which saves time and annoyance. No other adjuster on the market has this convenience for attaching. The adjuster is made in unique design, very light and compact, and has no heavy weight for the cord to support. Every adjuster is carefully inspected before leaving the factory, to see that it is in proper working order, and is warranted in every respect.

Fig. 2 shows the adjuster attached in position on the cord with a part of the brass shell broken away, showing the wood spindle with the cord in slot, through which it passes, the cord being in position, and the flange on wood spindle being partly broken away to show a portion of the regulating spring. In Fig. 1 is shown the adjuster with one-half the shell removed. This shell is made of brass, each half being stamped out separately. One-half has four slots, marked B, and the other has four V-shaped points, marked A. The wood spindle is secured to the latter, so it cannot be displaced while being attached to the cord.

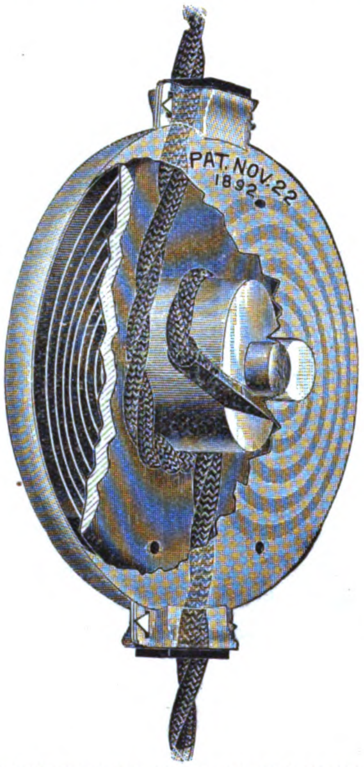


FIG. 2.—PORTER'S PATENT ADJUSTER FOR ELECTRIC LIGHTS.

The adjuster is attached to the cord in the following manner: Press the cord to back of slot in wood spindle, then place the shell with the B slots in position, so that the four V-points in A pass through the slots. Bend down the points, and the two halves will be held firmly together. On removing the pin C the adjuster is ready for use. The spring should be regulated to the right tension before fastening the two halves together. The position of the adjuster on the cord may be changed by simply pulling the lamp clear down and moving the adjuster to the desired position. The cord will slip easily through the slot in the spindle when in that position.

This adjuster is made in two sizes by Stephen Porter & Company, of 384 Atlantic avenue, Boston, Mass. No. 1 size adjusts from 0 to 30 inches, No. 2 size from 0 to 9 feet.

The Imperial Friction Clutch Pulley.

On account of the variable loads in central stations also in lighting and power plants in general, it is often required to shift the load from one machine to another. For use in this connection the friction clutch pulley possesses many advantages. In plants where the power is used for other purposes this affords an easy way of shifting the power and an easy way of throwing on or off the power from a dynamo or generator.

A new form of friction clutch pulley possessing many improvements has recently been placed on the market by J. W. Penfield & Son of Willoughby, Ohio. The mechanism of these pulleys is clearly shown in the accompanying cuts. The novel construction it is claimed secures increased efficiency, durability, ease of adjustment and quickness of repair, and at the same time overcomes the objections heretofore urged against friction clutch pulleys in general.

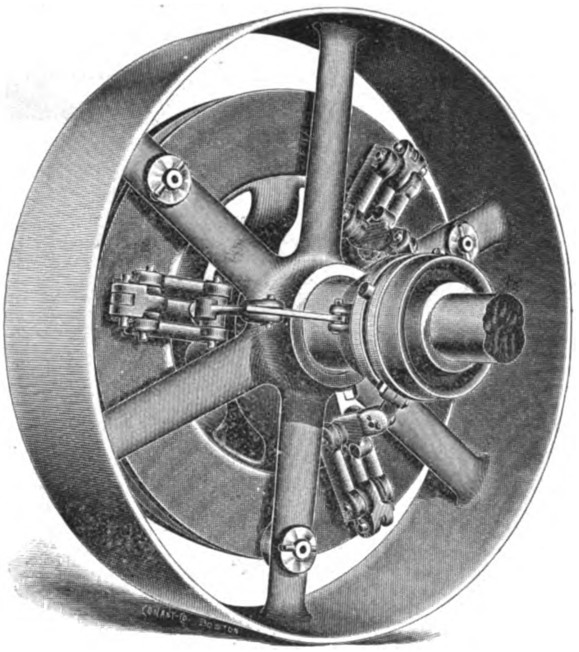


FIG. 1.—THE IMPERIAL FRICTION CLUTCH PULLEY.

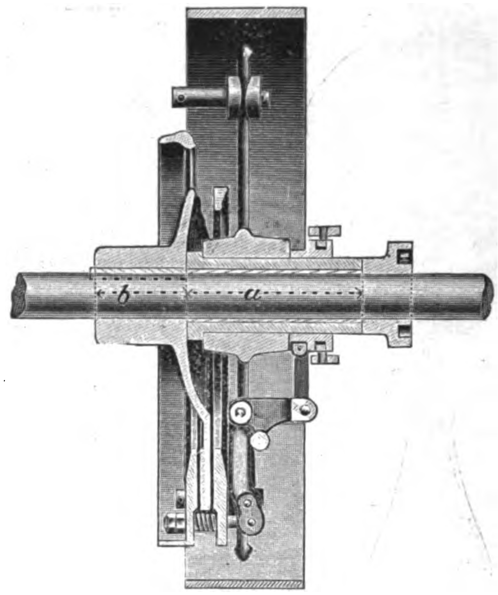


FIG. 2.—THE IMPERIAL FRICTION CLUTCH PULLEY.

As will be seen by an examination of the sectional view shown in Fig. 2, the Imperial pulley is provided with two cylindrical friction rings, between which is a friction disc. The friction disc is keyed to the shaft and turns with it, while the balance of the mechanism and the pulley is loose on the shaft. The clutch levers of which there are three sets on each pulley, clamp the friction disc between the friction rings, thereby setting the whole pulley in motion. The clutch mechanism is positive and quick acting, giving immediate control over the pulley.

The friction surfaces of the friction rings are protected by strips of insulated fibre, affording an extra precaution against wear. These strips can be replaced by others at any time, and this portion of the pulley kept as good as new. The bushings are made in halves and are renewable. They are babbitted and can be removed and rebabbitted at any time without taking the pulley from the shaft. As the bushing and friction surfaces are the parts subject to the greatest wear, the construction of the Imperial pulley, permitting the renewing of these parts readily, enables the user to keep his pulleys in perfect repair and running order, and adds to the profit of the investment.

In use on line shafting the advantages of clutch pulleys are well known. The belts stand still when not in use avoiding the wear of the belt and the power lost in turning the loose belt and pulley. Owing to the peculiar construction the friction disc is the only part of the pulley in motion when the pulley is out of clutch, the clutch mechanism and the balance of the pulley being loose on the shaft. Should an Imperial driving pulley on the line shaft slip at any time, the pulley may be thrown out of clutch and the adjustment of friction effected without stopping the shaft. This feature is of great advantage to any establishment, and especially to electric lighting plants or works where constant and continuous motion of the shaft is essential.

These pulleys are free from injurious effects due to centrifugal force. The resistance is in direct line with the strain, consequently centrifugal force does not exert a twisting force upon the clutch members, nor can it throw the pulley in or out of clutch. Thus there is really no limit to the speed at which the pulley may be run.

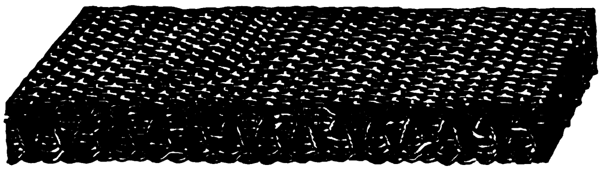
This pulley is free from complicated devices, has a large friction surface and occupies but a comparatively small amount of surface on the shaft, and it is a valuable addition to the extensive line of power transmitting machinery manufactured by this firm.

Maddox Cotton and Wire Belting.

The Maddox cotton and wire belting manufactured by the Maddox Wire Belt Co., for whom Mr. H. N. Green of 252-258 Fulton St., Brooklyn, is general agent, possesses many qualities adapting it for the efficient transmission of power. It is thoroughly water proof and is said to be unaffected by oils, grease, chemicals, dirt or changes of climate. It costs less than leather belting while it does not get hard or crack like the latter.

The belting is made of cabled soft steel wire and cotton, woven solidly together making a belt of great strength and durability. The cables of wire are each composed of six soft steel wires twisted together. They are laid lengthwise in the belting about one-eighth of an inch apart forming part of the warp. The cables compose about one half of the warp, the rest of the belt being composed of the strongest and best cotton yarn, spun with special reference to the purpose for which it is intended.

The woof is woven in solid with the warp, the process of weaving causing the cables of wire to become corrugated in form or doubled back and forth through the thickness of the belting. The cotton woof being woven in solid in the meshes of the cable gives the belt strength as well as flexibility; and make it impossible for the cables to pull out or for the belting to stretch or tear. This method of weaving also entirely conceals the wire cables so that they do not come in contact with the pulleys and are never in sight except when the belting is cut so as to show a cross section of the belting. The rough cotton surface of the belting forms an elastic, rough face that prevents air cushions being formed between the belt and pulley, but cause it to take a firm and tenacious hold on the pulley. The entire power of the pulley is transmitted, giving a steady, even motion to the machinery driven by the belt. This fact makes these belts of special advantage in driving dynamos and other electrical machines where steady and uniform speed is important. They require no belt compositions to be applied nor any special care to keep them in good condition. These belts do not need to be tightened but run with equal efficiency when loose, thus saving much wear and the trouble of tightening.



MADDOX COTTON AND WIRE BELTING.

These belts have been tested in running a great variety of machines and the results have been most creditable in all respects. For operating electric machinery the Maddox belts possess many qualities especially adapting them for the constant and continuous service required.

Clam Bake given by the American Electrical Works.

The clam bake given by the American Electrical Works on September 2d, was a most enjoyable outing to the members of the electrical fraternity. In response to the invitations of the company to its 15th annual clam bake the electrical friends of the company to the number of about 150 assembled at Haute Rieve.

Mr. E. F. Phillips the president of this company was present in his capacity of host which he knows so well how to fill. Everything for the entertainment of his guests had been provided and on their arrival they set out to enjoy themselves. The money stringency and cares of business were forgotten in the pleasures of the occasion.

The game of ball between New York and Boston aroused great enthusiasm and despite the coaching of the friends of New York the bean eaters ran up a score of 30 to 12. The foot ball game resulted in numerous badly disarranged toilets. Other games and sports were provided so that every one could find some form of amusement.

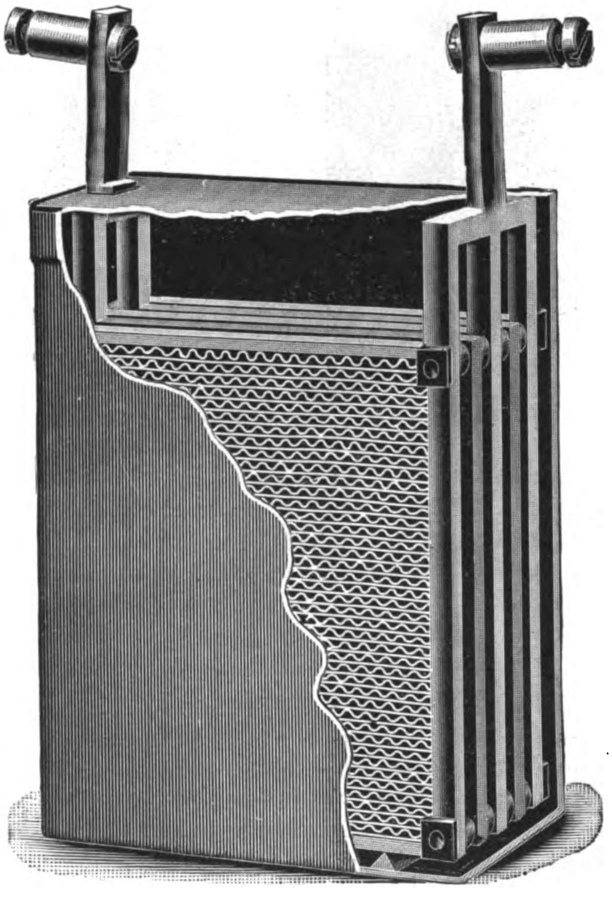
The photographer who is ever present on such occasions held the attention of the party on the steps of the Union Club House long enough to secure a photograph. The next attraction was the immense tent where dinner was served and an elaborate collation for which the American Electrical Works has gained a reputation was soon being enjoyed.

Mr. C. E. Stump acted as toastmaster and introduced Mr. Phillips, whose appearance was received with applause. In a pleasing manner he welcomed all present and referring to the hard times through which we are passing, said that through friendly assistance and sympathy we would weather the storm. Mr. Mark Day gave one of his humorous speeches and Mr. Frank Ridlon offered some appropriate words of council. Mr. H. M. Daggett, president of the Interstate Railway Company, Captain Brophy, Mr. Key and Mr. Cram were each well received and remarks appreciated.

Mr. Phillips and Mr. Sawyer were congratulated by all on the success of the day and to them the thanks and good wishes of all present were extended. The occasion will be long remembered as a red letter day for which the fraternity is indebted to the American Electrical Works.

The Franklin Accumulator.

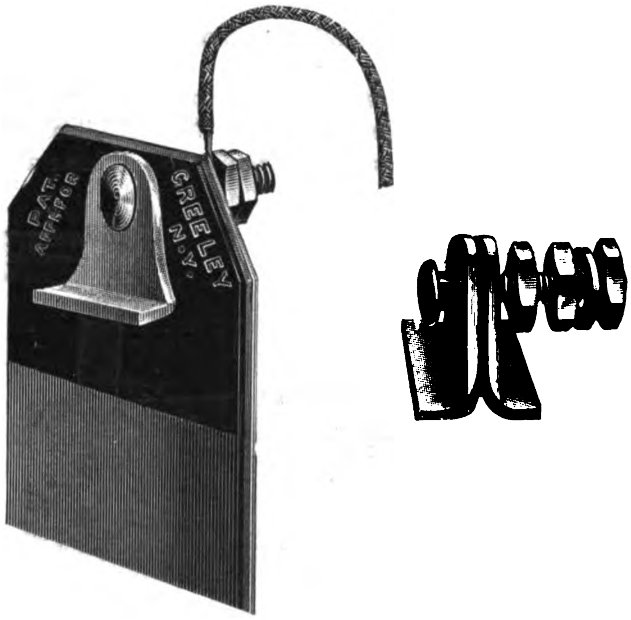
The Franklin accumulator, illustrated below, is manufactured by the Franklin Electric Co., 136 Liberty street, N. Y. It is of the lead-lead Plante type. It has a working E. M. F. of about two volts. The plate consists of a hard metal marginal frame, into which are packed, alternately arranged, straight and corrugated lead strips, securely fastened to the frame by specially prepared solder that is not affected by electrolytic action. The expansion due to the formation of peroxide, is absorbed by the fluted strips; the corrugations become deeper, folding upon themselves, and locking the active material into place so firmly, that it cannot be dislodged by the highest rates of charge and discharge.



THE FRANKLIN ACCUMULATOR.

The frame being of a harder metal than the interior lead filling, stiffens the plate, and is but slightly affected by the process of forming. No pastes or applied oxides are used, the active material being formed entirely of and on the plate itself. The construction of the plate exposes a very large surface to the action of the solution and current; and permits of high rates of discharge without a drop in potential.

In the nine plate pile of the 150-ampere hour cell, measuring 6 by 6½ by 7 inches, there are 32 square feet of surface, and in the five plate of the 100-ampere hour cell, measuring in the pile 3½ by 6½ by 7, there are 18 square feet. When assembled, each plate is insulated from its neighbor by three hard rubber separators one-fourth inch square, placed equally distant from each other on the surface of the plate, preventing all possibility of buckling. The pile is held together by rubber bolts which pass through the corners of the frames, and through holes in the ends of the outside separators.



S. & C. INTERLOCKING CARBON CONNECTOR.

The plates are securely connected by a lead bar, having a terminal capable of carrying a current of twice the capacity of the cell. The internal resistance of the Franklin accumulator is about .001 of an ohm. Two sizes of cells are carried in stock; type B in rubber jar 4⅝ by 7⅜ by 10 inches weighs, with solution, 24¾ pounds, and has a capacity of 100 ampere hours at 15 ampere discharge. Type C, 150 ampere hours, weighs complete 42¾ pounds in rubber jar, 7⅜ by 7⅜ by 10; other sizes are manufactured to meet the wants of purchasers.

The Franklin company's electric lighting installations in factories, residences and yachts have been very successful. Their largest plant is one consisting of sixty 1,000-ampere hour cells in the Manhattan Print Works, Passaic, New Jersey.

The S. & C. Interlocking Carbon Connector.

In the accompanying cuts is shown a new carbon connector just placed on the market by the E. S. Greeley & Company, of New York. In one cut the connector is shown in detail, and in the other attached to the end of the telephone standard carbon.

Since the introduction of carbon batteries for telephone service by the telephone companies, much trouble and annoyance has been caused by the use of a carbon connector which did not insure a tight and rigid connection with the carbon. There was no means of securely locking the wire in place, and loose connection would occur often through the handling of the battery, and not be noticed until considerable expense had been resorted to, to locate the difficulty.

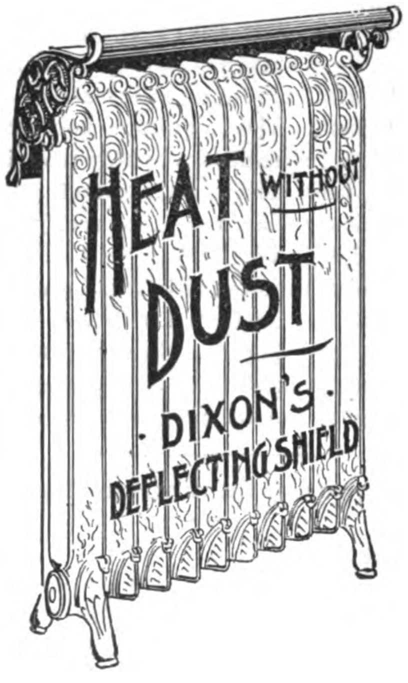
The E. S. Greeley & Co., which was among the first to recognize the fault with the old style, has produced a carbon connector called the S. & C. Interlocking, which they claim gives a perfect rigid grip upon the carbon and connecting wire, and will not turn or work loose after once having been locked in position. It is said that the S. & C. overcomes the faults found with the old style connector and is destined to replace all those of the old style now in use on the carbons of the telephone standard batteries.

The principal features of the S. & C. are its interlocking qualities, its large contact surface and the means of supporting the carbon on the battery cover.

It will be noticed in the detailed cut that the bolt has a square neck, and that it fits into square holes in the contact plates, thus interlocking, and prevents the bolt from turning when the nuts are screwed up.

Dixon's Patent Deflecting Shield.

As cold weather approaches and preparations are being made for heating offices, houses, etc., the device shown in the accompanying cut will be found a great protection to the walls and hangings. The constant current of air always present over the warm radiators carries the dirt and dust with it which combined with the moisture in the air which condenses on the cooler walls soon discolors the walls and decorations.



DIXON'S DEFLECTING SHIELD.

The deflecting shield is an ornament and in no way detracts from the beauty of the radiators. It does not enclose the radiator as in the old form which in that way reduced the effectiveness of the heating surface, but tends to throw the heat toward the center of the room where it is needed. These shields have been appreciated by users of steam and hot water heaters as a great protection to the fine interiors of their buildings.

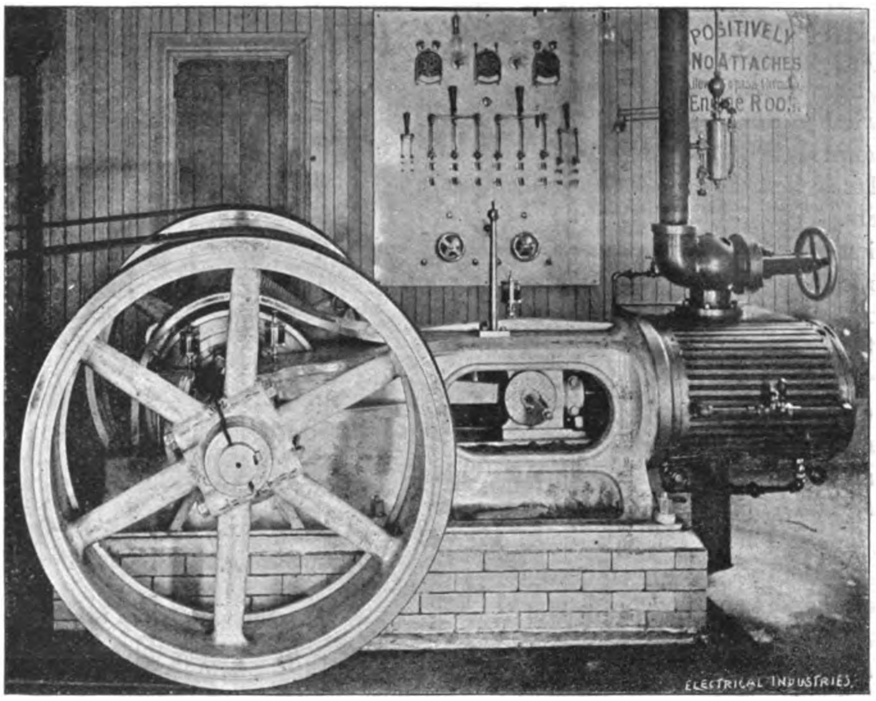
The shields are finished in any desired color or design and are made of sheet iron, Russia iron, copper, brass, nickel with the respective metal finish or with oxidized plated finish. They are manufactured by the Van Auken Steam Specialty Company of which Mr. C. P. Monash is manager at 201-207 So. Canal St., Chicago.

A School of Applied Electricity.

There has just been opened at Cleveland, Ohio, under the direction of Prof. E. P. Roberts a school of applied electricity. The prospectus outlines a plan of instruction both by correspondence and personal attendance at the school. Prof. Roberts has had an extended experience abundantly qualifying him for the work he has undertaken and his assistants have undoubtedly been selected with a view to their special fitness for the particular branches of instruction. After graduating from Stevens Institute in 1877, Mr. Roberts entered practical work but at the same time taught a night school in mechanical drawing at Newark, N. J. In 1831 he was connected with the United States Company as assistant to Mr. Maxin and afterwards as laboratory assistant to Mr. Weston. Since that time he has been connected with a number of electric and gas companies as superintendent or manager. More recently Prof. Roberts has been associate professor of electrical engineering at Cornell University and consulting engineer with an office in Cleveland which he still continues.

The Lighting Plant of the New Palace Theatre. Allegheny, Pa.

The New Palace Theatre of Allegheny, Pa., which was opened on Monday, August 21st, possesses one of the most substantial and complete electric lighting plants in Western Pennsylvania. The entire plant was installed by the Austin Engineering Co. of Pittsburg, Pa., and consists of a nominal 80-horse power centre crank M. A. Green automatic cut-off engine, manufactured by the Altoona M'f'g Co. of Altoona, Pa., for whom the Austin Engineering Co. are the general agents. This engine is very highly finished in white, gold and blue and presents a remarkably fine appearance from the lobby from which point it can be seen through the glass partition.



THE LIGHTING PLANT OF THE NEW PALACE THEATRE, ALLEGHENY, PA.

The dynamos are multipolar of the latest design from the Western Electric Company and were purchased through their New York house. They run at a speed of 400 revolutions and have a rated output of 26 K. W. The machines do their work in a very cool, quiet manner and have been the subject of much favorable comment from local electricians.

The switchboard, also manufactured by this company, is of white marble, on which is mounted the volt meter ammeters and switches, all of which are highly finished and present a very ornamental appearance.

The stage regulating mechanism is mounted on marbleized slate and all the rheostats are of the Carpenter enamel variety and take up so small a space that it is almost impossible to make the uninitiated believe that they are "all there." The steam plant includes one 100-horse power "Economic" boiler, built by the Erie City Iron Works, of Erie, Pa. The entire plant was installed under the personal supervision of Mr. David W. Dunn, general manager of the Austin Engineering Co., with an idea of permanence and its substantial look is ample evidence of this statement.

Three Point Incandescent Switches.

BY ALBERT SCHEIBLE, M. E.

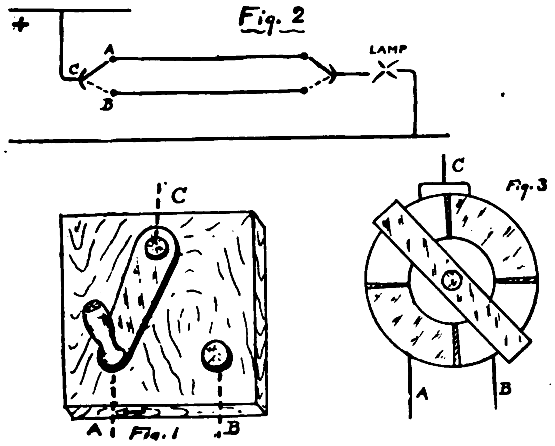
In its earlier and rather crude forms, the three-point switch has been used for years, perhaps ever since incandescent lighting began to spread, but it is only recently that properly built switches of this form have been put on the market. These are now to be had readily and at so low a figure that they ought to be used quite extensively; yet the demand for them has grown very gradually and seems not at all in keeping with the adaptability of such a device.

Probably the reason for this, lies in the dearth of printed matter mentioning such an article and the fact that the average wireman either is not familiar with three-point switches at all or does not know how to wire them up. In view of this I think that a brief explanation of the three-points switch and its uses, together with some diagrams showing the connections, may help to open up methods of wiring which ought to be much more common throughout the country.

The term 'three-point' switch is more easily understood when we look at the ordinary single-pole, snap switch as a 'two-point' switch, counting the pivot as one terminal and the contact post as the other. Taking an early form of switch, as in Fig. 1, we merely need to use the dead point

B as another terminal in order to make it a three-point switch. Then the moving lever will connect the pivot C with either A or B, so that as far as the single switch is concerned one circuit is always closed and the other open. By connecting two such switches, as shown in Fig. 2, we are able to open or close the lamp circuit from either switch, no matter how far apart the switches may be.

Electrical history does not tell us the first user of this method of wiring and judging from its simplicity it seems likely that many may have struck upon this idea independently. I remember penciling it out some six years ago when I met the simple problem of electric train lighting. Would the brakeman have to walk through the car at dusk in order to turn the switch at the farther end? This query led to the diagram shown in Fig. 2 which is typical of the method of wiring lights so that they can be controlled from either one of two points.



THREE POINT INCANDESCENT SWITCHES.

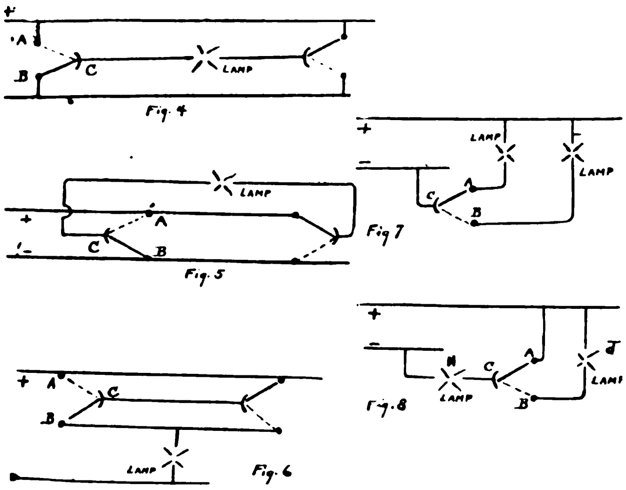
Of course the location of two switches makes no difference as long as the connections are properly made, so this system lends itself readily to various conditions and helps to save many a step. One favorite use is for controlling lights in corridors, especially at stairways; then the light can be turned on from one end of the hallway, and off from the other, there being no need of groping around in the dark for the switch. Contractors who are familiar with this 'lazy man's switch' have been able to use it to advantage in a good many ways, indeed I have found wiremen whose ranking above their competitors was due largely to their acquaintance with this simple switch. This is another instance showing the need of keeping pace with the small improvements as well as the larger ones, a point too little appreciated by most construction men.

As to the three-point switches themselves, they can be made in many different styles, most of those on the market being modifications of standard single or double pole snap switches. Fig. 3 shows the general arrangement of those having a rotating contact arm, two of the four terminals being joined to form the pivot point C, while the other two terminals, A and B, form the odd points corresponding to the same letters in Figs. 1 and 2. Let me add right here that some makers have offered such devices under the misleading name of 'three-way' switches, though it is evident that there are but two positions of the switch possible. It is to be hoped that this confusing term will not be allowed to get a good foot-hold.

At first thought it would seem that the matter of connecting these switches is a simple problem, so that no special instructions would be needed. But I have found that some wiremen can devise methods of their own which may work successfully, but which are either too complicated or have unnecessary elements of danger. Thus Fig. 6 shows a method used by some, which works just as well as the one shown in Fig. 2, but is less simple and requires an additional length of wire corresponding to the distance between the two switches.

Then the two diagrams Figs. 4 and 5 show methods which are objectionable on account of the risk of shortcircuiting the mains in case the moving contact bar should touch both A and B at the same time or in case moisture causes a leak between these two points. Of course this ought not to happen with a well designed and properly installed switch, but practice has shown that this point should not be overlooked. In the typical diagram (Fig. 2.) such a path from A to B would merely light the lamp as it is always in series with the switch; but in a case like Figs. 4 or 5 it would shortcircuit the mains, and probably ruin the switch itself. All the other plants which I have seen, can be reduced to one of these four diagrams and as the last one is too complicated while the second and third are unsafe, the first method ought to have the preference. This consists in connecting the odd points on the two switches with two parallel wires; then connect one pivot point direct to the supply wire and the other through the lamp to the other wire. It is immaterial which pivot point you connect to the positive or the negative wire, the signs in the diagrams being put in merely to distinguish the mains.

Two of the other uses of the three-point switch are worthy of special notice. One is for turning on either one of two lights, thus allowing the consumer to wire up two lamps in the rarely used parts of his store or house while his contract calls for the use of but one light at a time (See Fig. 7). Then for a night light the arrangement of switching another lamp (J) into series with the first lamp (H) so as to dim this light is often very serviceable. Fig. 8 shows how this is done, a key socket at the lamp H, serving to turn off the light when none at all is wanted. Other applications of these simple switches are easily found and it is to be hoped that they will soon have the widespread use which they certainly deserve.



THREE POINT INCANDESCENT SWITCHES.

A final decree has been entered by Judge Grosscup in each of the suits brought by the Edison Electric Light Company against the Illinois Electric Lamp Company and the Sunbeam Incandescent Lamp Company for an injunction and accounting. The decree gives the complainant nominal damages and a perpetual injunction. The settlement is an amicable one, counsel for the several litigants agreeing to the form of the order of court.

A BREIF REVIEW.

L'Electrician, Paris, Aug. 26th, contains a description of an underground electric railway with plan and profile of the city proposed by M. Mullender for the city of Brusels. The ground on which the city stands is very uneven and the roads from the lower to the upper parts of the city are very steep. The line of the road encircles the city following very nearly the line of the streets. The engineer says: that considering the unevenness of the ground for Brusels, the underground electric railway is the most appropriate, that it will give the best service and at the same time the best results from a financier's point of view. The tunnel will be about 10 feet in diameter and will be constructed as near horizontal as the unevenness of the ground will permit. Twelve stations are planned for, reached from the surface in most cases by elevators. The trains are to consist of a motor car and two trailers. The stations, tunnel and cars are to be lighted by electricity and not only the trains but also the elevators will be run by electricity. Telephones, signals, etc., are included in the proposed plans. It is estimated that 2,400-horse power would be required to operate the system including the trains, elevators, lights and signals furnished from a central station. Two years would be required to complete the work and three and one-half million dollars would be required for its construction and complete equipment.

The need of better brakes on electric cars in not sufficiently realized by street railway managers. With the improved methods of traction and the increased speed secured not enough attention has been given to the methods of controlling the cars, although a variety of excellent devices are on the market. In the following paragraphs from an article in a recent issue of the Engineerings News will be found some facts regarding the grades of electric lines and brakes which may be of interest.

"On ordinary railways operated by locomotives, 4 per cent is about the maxium grade that is ever used, although eight per cent and even 10 per cent have been used on temporary mountain lines. Horse railways have been practically restricted in maximum grades to that up which a pair of horses with one or two helpers can haul a loaded car. The electric car, however, is confined within no such narrow limits. The enginneer laying out an electric line nowadays puts it where the greatest traffic is to be had regardless of grades, unless something steeper than about 10 per cent is encountered.

"At present nearly all electric cars in use have brakes applied by hand, and the motorman, if properly instructed, can vary the braking force according to the load in the car, the speed at which he is running and the condition of the rail, so as to get the maximum braking force without slipping the wheels. It is probable that air-brakes of some sort will before long displace hand brakes on electric cars, and it is a point worth noting that in their design provision should be made for varying the braking force to suit the conditions. The superiority of the air-brake to the hand brake arises from the fact that it can be applied practically instantaneously, whereas with the hand brake one to two seconds is required to take up the slack in the brake rigging and apply the brake with full force. With trailing cars there is, of course, a further advantage from the use of the air-brake, as the motorman at the head can apply brakes on the whole train as quickly as on one car.

"But to handle electric cars safely on steep grades, quickness of application is not after all so important as certainty of application with full power. All parts of the brake rigging should be designed with so large a factor of safety as to make breakage impossible, and in designing the rods, levers, etc., every possible chance of fouling should be watched for and guarded against. The leverage should be sufficient to enable the motorman to exert a pressure on the brakeshoes at least equal to the weight of the car, and the brake gear should be proportioned throughout for the strain due to the maximum leverage. Were these precautions taken, the failure of brakes on an electric car would be an unheard-of-occurrence.

"A question which deserves some attention in this connection is whether in the interests of safety the limiting grade on electric car lines should not be that at which the car will stop supposing the brakes to be locked and the wheel sliding on a greasy rail. If we may trust the Cincinnati papers, in one of the recent street car accidents in that city a car with its motor disabled on a steep grade started down the hill with the wheels sliding. Is not a grade on which such an accident could occur steeper than should be operated? What grade this would fix as the limit for street railway work is uncertain. Experiments on the Paris, Lyons & Mediterranean Ry., in France, in 1851, showed a coefficient of friction of .11 between the wheel and the rail for a railway car with wheels locked and sliding, moving on a damp rail at a speed of 18 to 20 miles per hour. This would give a 11 per cent grade as that at which the friction of the sliding wheels would equal the accelerating force due to the grade. In street railway service, however, the rails are liable to be coated with a slimy street mud, which, acting as a lubricant, must considerably diminish the coefficient of friction. If rails on steep grades are liable to this, it seems a fair conclusion that the limiting grades should be made much lower than is common practice at present.

"The alternative to this, and one which deserves attention from those in charge of street railway lines with very steep grades, is the adoption of some auxiliary method of traction on the steepest grades. Such methods, indeed, are already in use, the auxiliary counterbalance system in use at Portland, Ore., and Seattle, Wash., and the ingenious central rail system devised by Mr. H. L. Van Zile, of Albany, N. Y. While the cost and complexity of any such additional devices will be considered an argument against them by street railway managers, it will eventually be found in street railway traffic as on steam railways that safety must be made the paramount consideration. The rapidly increasing number of accidents on electric railways is attracting much attention, and greater efforts ought to be made on the part of those responsible to remove the causes of these unfortunate occurrences."

The University of Illinois make a very creditable display from the department of electrical engineering on the main floor of the state building at the Fair. A direct current dynamo, mounted on a cradle dyanometer and driven by a motor, furnishes current to several arc lamps and for the lighting of a number of incandescent lamps, arranged to form the college monogram placed above the exhibit. A fully equipped switchboard, a water rheostat, a number of sets of apparatus for typical experiments in electrical measurements and various styles of storage batteries, some of which were made by students, are also exhibited. A very good idea of the work done at the school may be gained by examining the photographs of students engaged at work in the rooms of the electrical laboratory.

FINANCIAL.

The past month has witnessed an improved condition of business. Prices have not advanced very much, but the increase in the amount of money in circulation is noticeable. The clearing house certificates issued during the greatest stringency are being called in. In six weeks the actual cash holdings of the New York banks are said to have increased $28,000,000.

The first payment in settlement of the claims against the Chicago national banks that failed has just been made, which is significant of the improvement in the situation, as many accounts were realized upon that were exceedingly doubtful a few months ago. In the electrical trade business has been quiet, and collections slow. The street railway business has nearly closed for the season except in the supply lines. To manufacturers the prices of the raw materials have been the lowest known. This is especially true of the metals; copper is lower than after the collapse of the French syndicate; zinc and lead are also very low.

In the stock market General Electric has received the greatest attention, and has experienced the same fluctuations of the previous month, but has returned to about 40. Ft. Wayne rose a few points on the circulation of favorable reports. Westinghouse stock is a few points higher. Stocks and bonds in general rule low, and have been very weak.

NAME OF COMPANY.	DESCRIPTION OF SECURITY.	AMOUNT ISSUED.	PAR VALUE.	RATE INT.	DATE PAYABLE.	CLOSING July 29
Miscellaneous Securities.						
American Bell Telephone Co....	Stock.	$17,500,000	100	....	J. Q.	190
" " "	Bds. 1893.	2,000,000	100	7	F. & A.	107
American Tel. & Cable Co... ...	Com.	14,000,000	100	....	....	79
Commercial Cable Co...	Com.	7,716,000	100	....	....	120
Edison Elec. Ill. Co., Boston....	Com.	2,025,800	100	....	F. Q.	125
" " " ...	C. Bds. 1898.	71,000	100	6	M. & S.	.....
" " "	C. Bds. 1901.	586,500	100	6	M. & N.	.....
" " Brooklyn..	Com.	2,500,000	100	....	Q. F.	85
" " " ..	1st. 1940. Regis.	500,000	100	5	A. & O.	.....
" " " ..		....	100	5	A. & O.	.....
" " Chicago...	Com.	3,000,000	....	8	Q. F.	.....
" " "		2,500,000	....	....	....	.....
" " New York.	Com.	7,938,000	100	....	Q. F.	97
" " "	1st 1910.	2,562,000	100	5	M. & S.	103½
" " Phila......	Com.	1,473,000	100	....	....	120
" " "		....	....	5	....	.....
Fort Wayne Elec. Co...... ...	Com.	4,000,000	25	....	....	4½
General Electric Company.	Com.	30,457,000	100	....	......	40⅜
" "	Prf'd.	4,251,900	100	....	....	71
" "	Deb. 1922.	10,000,000	100	5	J.-D.	76
Gold & Stock Tel. Co............	Com.	5,000,000	100	....	Q. J.	... .
Northwestern Gen. Elec. Co....	Com.	1,000,000	100	....	....	.....
" " "	Prf'd.	750,000	100	....	J. Q.	.....
Thomson Elec. Welding Co......	Com.	1,000,000	100	....	....	.....
Thomson European Welding Co.	Com.	1,500,000	100	...	....	.....
Thomson-Houston Elec. Co . .	Series D.	1 0,000	10	....	....	5
Thom'n-Houst'n Intern. Elec. Co.	Com.	600,000	100	..	....	.....
" " " "	Prf'd.	400,000	100	....	....	.....
United Electric Securities Co....	Com.	1,000,000	100	....	....	.....
" " "	Prf'd.	1,000,000	100	....	F. & A.	....
Western Union Tel. Co..........	Com.	94,820,000	100	....	Q. J.	79⅛
" "	Var. Issues	13,088,000	10	7&5	M. & N.	.....
West'gh'se Elec. & Mfg. Co	Ass'ing.	5,333,940	50	....	....	21½
" " "	1st Pf. Cum.	3,755,700	50	7	....	40
Electric Railway Securities.						
BROOKLYN—						
Brooklyn City R. R..............	Com.	6,000,000	10	....	Q.-J.	170
" "	1st Bds. 1916	3,000,000	100	5	J. & J.	90
Coney Island & Brooklyn R. R..	Com.	500,000	100	....	Oct. 1.	.....
" " " ..	1st Bds. 1909	300,000	100	5	J. & J.	.....
" " " ..	Certf. 1894.	300,000	100	6	J. & J.	.....
BUFFALO—						
Buffalo St. Railway..............	Com.	5,370,500	100	5	....	.....
" "	Bds. 1931.	5,000,000	100	....	F. & A.	.....
BOSTON—						
West End St. Railway...........	Com.	9,085,000	50	..	J. & J.	56
" "	Pf'd.	6,400,000	50	5	J. & J.	78
" "	Bds. 1902.	3,000,000	100	....	M. & N.	.....
LOUISVILLE—						
Louisville St. Railway Co.........	Com.	5,000,000	100	....	....	.....
" "	Prf'd.	1,000,000	100	5	A. & O.	.....
" "	1st Bds. 1930	6,000,000	100	....	J. & J.	.....
NEWARK, N. J.—						
Newark Passenger Railway......	Com.	6,000,000	100	....	....	27⅜
" "	Bds. 1930.	6,000,000	100	5	J. & J.	84½
NEW YORK—						
Union Railway Co...	Com.	2,000,000	100	....	....	155
" "	Bds.	2,000,000	100	....	....	.....
PITTSBURGH—						
Duquesne Traction Co........ ...	Com.	3,000,000	50	...	....	24
" "	Bds. 1930.	1,500,000	100	5	J. & J.	100
Fed. St. & Pleas. Val. R. R.......	Com.	1,400,000	50	....	J. & J.	16⅝
" " " " "	Bds. 1919.	1,250,000	100	5	J. & J.	100
Pittsb'gh, Aleg. & Man. R. R.....	Com.	3,000,000	50	....		42
" " "	Bds. 1931.	1,500,000	100	5	J. & J.	99½
Pittsburgh & Birming. R. R....	Com.	3,000,000	25	....	....	17¾
" " "	Bds. 1929.	1,500,000	100	5	M. & N.	97¾
ROCHESTER—						
Rochester Railway Company....	Com.	5,000,000	100	....	....	.....
" " "	Bds. 1930.	3,000,000	100	5	A. & O.	95
ST. LOUIS—						
Lindell St. Railway..............	Com.	2,500,000	100	....	Q. J.	50
" "	Bds. 1910.	1,500,000	100	5	J. & J.	[illegible]
St. Louis & Suburban............	Com.	2,500,000	400	....	.... ..	50
Union Depot Railway............	Com.	1,200,000	100	....	....	.....
" " "	Bds. 19 0.	1,000,000	100	6	A. & O.	100

* And interest bid.

A consolidation is proposed of the Thomson Electric Welding Company and the American Projectile Company of Boston, Mass. The two companies have been very closely connected for some time, and the stock has been held by practically the same parties. The Welding company is capitalized at $1,000,000, and the Projectile company at $500,000. The latter company pays the former a royalty on every weld made. It is said that the Projectile company has an order from the United States and other governments for the manufacture of shells that will keep the works busy for some time. It is thought that by consolidating the companies a large amount of expense will be saved.

It is reported that the Ft. Wayne Electric Company will establish offices of its own in different places for the distribution of its goods, and will hereafter maintain an independent existence.

The Scuyler factory, at Middletown, Conn., of the General company has been closed, aud the work that would have been done there will now be done at the Lynn factory.

The General Electric Company is cutting down expenses, and in the matter of saleries alone the reduction is said to amount to $12,000 a month. Its heavy expenses at the Fair have been referred to and its investments there. The Intramural Railway is said to have cost $850,000. Its net income during the period of the Fair is conservatively estimated at $400,000, and if a salvage of 50 per cent be secured on the plant, the company will come out very nearly even. In a recent number of the United States Investor appeared the following: "There is no doubt but what the General Electric Company has suffered more acutely than any other single corporation during the late financial stringency. Although it is receiving many cash orders, and has a good immediate prospect, it is not at present, nor has it been for some time back, paying expenses, or hardly the interest on its large plants. When business assumes its accustomed prosperity, it will be some months before the damage that has been done can be repaired. If the company pursues legitimate methods, stockholders will do an extraordinarily good thing if they only miss three dividends."

The sale of the property of the National Electric Manufacturing Company, of Eau Claire, Wis., has been postponed by order of the courts until November 1, 1893.

NEW BOOKS.

Second Report of Bureau of Mines, 1892. Printed by order of the Legislative Assembly of Ontario. Toronto, 1893, Warwick & Sons. 264 pages.

This report gives statistics of the areas of mineral lands sold and leased during the year 1892, and the mineral production for the year ending October 31. The state of the iron industry and resources of the province, with a review of its history, is given. A considerable space is also given to the production of copper and nickel and the mining laws of Ontario. The paper read by Dr. A. P. Coleman before the Geological Section of the Canadian Institute in Toronto, on Ontario Minerals at the World's Fair, is included in this report, which is a very interesting paper.

Electric Lighting and Power Distribution, Part III, by W. Perren Maycock, M. I. E. E., 1893. Whittaker & Co., London and New York. A. C. McClurg & Co., 117-121 Wabash Avenue, Chicago; price, $0.75.

This is the third volume and completes the work. It opens with a chapter on electrolysis and the effects of the current on different solutions, which prepares the way for the study of secondary or storage batteries. The early forms of these batteries are described and illustrated and also the later modifications of the batteries. The descriptions are elementary and are written in a clear and comprehensive style. The transformer is next considered. The principles involved are plainly defined. The methods of construction of the different forms of transformers is explained and switches, fuse-blocks, cut-outs, etc., are illustrated and described. The principal forms of lightning arresters are shown, and the various systems of electric lighting with the rules and principles that govern their installation are discussed. The closing chapter is taken up with a forecast of the immediate improvements in the commercial application of electricity as promised by the latest experiments and discoveries of Tesla, Swinburne and others. This complete work presents to the student and reader a general plan of the electric field of lighting and power distribution. It cannot fail to be of assistance to all who desire a general knowledge of the applications of electricity, as it is written in the plain and lucid style for which the author is well known.

TRADE PUBLICATIONS.

Insulation is the title of a neat little pamphlet issued from the World's Fair headquarters of the electrical department of the H. W. Jones Manufacturing Company. A description of the various insulations manufactured, and the many ways in which they are used, compose the contents.

A comprehensive catalogue of the Imperial friction clutches has been received from Messrs. J. W. Penfield & Son, of Willoughby, Ohio. The construction and operation of these clutches is fully illustrated and described. The catalogue is well made up. The type and paper were well selected, and together they boldly present the clutches of this firm.

An artistic souvenir is being issued from the World's Fair headquarters of the Dodge Manufacturing Co., of Mishawaka, Ind. The engravings showing the works of the company in 1878 and 1893, with the history of the company are interesting, not only as showing progress made by the company, but also as showing the advancement made in the systems of power transmissions. This is further shown by the views of engine rooms, and also by a description of the shafting and pulleys used in Machinery Hall.

Users of belting will find in the new catalogue of the Chas. Munson Belting Company, of Chicago, much valuable information. The lists include not only flat leather belting of various width, but also round and twisted belting and belt supplies of all kinds. It is nicely gotten up and finely printed on heavy paper. An attractive feature of the catalogue is the large number of half tone engravings showing numerous lighting and power plants using the Munson belts, accompanied by fac simile letters from users of the belts. The catalogue was designed and printed by H. B. Prindle & Co., and is a credit to them in every respect.

The Engineering Review, London, Eng., which made its first appearance on July 20,enters a useful field of journalism. It is distinctly cosmopolitan, and leaves no part of the world out of its range. It is intended to be an epitome of the world's current engineering literature, and to give to all interested in engineering of whatever kind information of what is going on in the engineering world. The number of papers published on these subjects has become so large that few have the time to do them justice, and to the busy man, if its originator carries out his idea, he will give the meat of the engineering press, and the index of current literature will indicate to the specialist where he may find the articles that will interest him most. This review appears on the 20th of each month, and is sold at a sixpence.

The catalogue of the courses in electrical engineering and physics for 1893-4, from the Massachusetts Institute of Technology, is an improvement on previous years. The equipment of these departments is illustrated by numerous cuts showing the machines, instruments, laboratories and lecture rooms, with the students at work. With the development of the telephone and the introduction of electric lighting, the studies in electricity were extended, and as the interest increased and its commercial importance broadened, preparations were made for the establishment of a course in electrical engineering which was formally announced in 1882. From that year to the present its facilities for instruction in theoretical and practical electricity have increased, and the course as now laid out is most thorough in all branches.

Poplar Astronomy is the title of a new monthly magazine that makes its first appearance with the September number. It is edited by Mr. Wm. W. Payne and Miss C. R. Willard, of Goodsell Observatory of Carleton College, Northfield, Minn. It enters a new field designing to furnish a magazine of interest to popular readers, teachers, students of astronomy and amateurs. The initial number gives promise of success in this line. The contributors are among the more prominent astronomers, many of whom have contributed to literature interesting and valuable articles. Among those whose articles appear in this number are Prof. James E. Keeler, director of the observatory at the Western University of Pennsylvania; Prof. Winslow Upton, director of Ladd observatory, Brown University; Dr. Lewis Swift, of the Warner observatory, Rochester, N. Y., whose many articles on astronomical subjects havs been well received, and especially the series of papers of a popular character that appeared a few years ago in the Post Express of that city, and others. Readers may expect contributions from E. E. Barnard, of Lick observatory; Prof. Geo. E. Hale, director of the new Yerkes observatory at Chicago, and many others both American and foreign.

Catalogues are now considered a most important factor in the sale and the distribution of manufactured articles, and in no class of trade does it play as important a part as in the electrical industry, for in no trade are there as many changes and improvements constantly being made. In this trade the catalogue presents to the customer the many improved articles, as well as those that have come to be looked upon as standard. Realizing the value of the catalogue in presenting to the distant customer the extensive lines of goods carried by this house, and to the local customer, in keeping before him the lists and sizes of goods, the Central Electric Company, Chicago, has produced a handsomely printed catalogue for 1893 that is unsurpassed for size and general excellence. It is well made and substantially bound and is an ornament to any office. It is most intelligently arranged, every article being arranged under its appropriate heading. The first division of the book is devoted to Okonite wires and products, which include telephone and telegraph wires; electric light and railway wires for every purpose, high and low tension currents, for underground and overhead construction, concentric cables, tapes and compounds. Each class and kind of conductor is carefully specified, and in the table of sizes is given the weight, resistance per mile, etc. Bare copper wire, magnet wires, steel line wire, German silver resistance wire, suspension cables, and wire for every purpose in the industry are grouped under the head of wires. Motors and motor appliances, of great variety, are fully illustrated in their department. The requisite conduit, fittings and appliances for the installation of the Interior Conduit system of electric wiring, for which the Central company is western agent, are listed and extensively illustrated. Under the headings, construction material, tools, incandescent light supplies, arc light supplies, station and line supplies, test instruments, telegraph, telephone and fire alarm supplies, battery materials and house supplies are listed extensive lines of goods, accompanied by illustrations, giving clear ideas of the goods handled. Appended to the volume of over 500 pages are numerous tables and other valuable information which will be found invaluable to electrical men.

PERSONAL.

Mr. Albert Scheible, Chicago, returned from a three weeks vacation recently.

Mr. L. E. Miller, a dealer in electrical supplies, at Houston, Texas, paid Chicago a visit last month.

Mr. G. A. McKinlock, of the Central Electric Company, Chicago, has just returned from an extended trip to New York.

Mr. Harry A. Kinney, for several years past connected with the electric lightning industry, was married on September 4 to Miss Mary L. Hance, at Detroit, Mich.

Mr. W. W. Burnham at a recent meeting of the Electric Gas Lighting Co. was appointed general manager of that company, to succeed the late Mr. L. W. Burnham.

Mr. James Allen Lounsbury, recently connected with the engineering department of the Worlds Fair, was married on September 26th to Miss Gertrude Greenlee of Chicago.

Mr. W. S. Bartholomew, of Bartholomew, Stow & Co., Chicago, is making an extended trip via Minneapolis and St. Paul to Iowa points, and reports a revival of business all along the line.

Mr. B. J. Arnold, for several years connected with the railway department of the General Electric Company, retires from the service of that company the first of this month, and can hereafter be found at 565 The Rookery, Chicago, where he has opened an office as consulting and supervising engineer.

Mr. Gilbert Wilkes, well known through his connection with the Edison General Electric Company as district engineer of the eastern district, and more recently as chief engineer of the Detroit Electrical Works, has opened an office at 149 Griswold St., Detroit, as consulting engineer. Mr. Wilkes is a graduate of the United States Naval Academy, and of the course in electrical engineering at Johns Hopkins where he took a post graduate course of three years, and his extended experience and excellent qualifications will undoubtedly give him the success wished for by his many friends.

BUSINESS NOTES.

Mr. Walter S. McKinney, M.E., 225 Dearborn St., Chicago, has secured the western agency of the Pierpoint water tube safety boilers, and is now able to furnish the complete equipment of power plants of all kinds.

Bartholomew, Stow & Company, Chicago, have placed a large number of Nutting arc lamps on the market recently of the perfected pattern which are giving universal satisfaction. They are now able to fill orders for any quantity promptly.

The Railway Equipment Company, Pullman Building, Chicago, have closed a contract for the equipment of the Oil City, Pa., Electric Railway. Other contracts are also reported by the company for type G. overhead material. The company has had a large increase in its supply business during the past few weeks.

The Hale Elevator Company, Chicago, has issued a very neat four-page cardboard folder giving data in regard to the electric elevators in the Manufactures Building and many items of interest relating to the building itself. These elevators have carried nearly 400,000 visitors to the roof of the building since the opening of the Exposition.

The La Roche Electrical Works is now well established in its new factory at the corner of American and Diamond Sts., Philadelphia, and prepared to fill orders promptly for electrical machines and apparatus. A number of new plants have been equipped in the east and south by this company, which are evidences of the superior quality of the company's equipments.

The Royal Columbian Electric Company, Chicago, has filled several important orders for Royal columbian alternators during the past month. Mr. H. R. Fish, Jr., secretary of the company, has recently returned from a trip to the factory at Peoria, and reports that arrangements for increasing the plant are in progress and that there is some talk of moving it to Chicago.

Since putting in seven new boilers at their Cedar Ave. power station the Cleveland Electric Railway Co. have 35 No. 5 Reliance safety water columns, manufactured by the Reliance Gauge Co., Cleveland, Ohio, on their boilers, some of which have been in use for more than five years. They state they would no more think of operating the boilers without them than without the pop valve.

The Beacon Vacuum Pump & Electrical Co.'s factory is running full time and it will soon be able to turn out from seven to eight thousand lamps per day. The company has decided to limit the number of license for the manufacture of these lamps to six companies so that parties desiring to manufacture under these patents would do well to apply immediately for the right as nearly the entire number of applications have been received.

Electric Gas Lighting Company, of Boston, Mass., although it recently sustained the loss of its general manager, will be continued under the same progressive methods. At a recent meeting Mr. A. A. Sweet, a director, was elected president; Mr. Arthur Drew, treasurer, and Mr. W. W. Burnham general manager. The officers of the company are all experienced men, and their long connection with the company shows their ability as apparent in the success of the company.

The Electric Appliance Company report a number of large sales of their celebrated "O. K." weatherproof line wire. They state that their experience proves that the trade appreciate the superior merits of this weatherproof insulation, and of its being sold under a particular brand which insures their receiving a first-class article when the name "O. K." is appended to their orders for weatherproof wire. The time when weatherproof wire orders can be filled with anything having a black cover is rapidly slipping away.

The Buckeye Electric Company, Cleveland, Ohio, is to start up its factory early in October. In the manufacture and sale of its new lamp, it announces to its customers that the protection of the courts will not be necessary, as the lamp will be made under new and non-infringing patents. The filament, however, it is said, and some other of the peculiar characteristics of the old Buckeye lamp, will be used in the new. The company expects to run at its maximum capacity, which is between three or four thousand per day. The mark set is one million lamps for the coming year.

McLean & Schmitt, 195 South Canal St., report a good and increasing business in armature rewinding, and have recently completed a number of pieces of work from outside the city. A contract for the wiring of the Schoenhoffen Brewing Company's plant has been signed by this company, and the plant installed by them in the fine new store of John York, 779-788 South Halsted St., has just been accepted. This is the third time that Mr. York has intrusted the installation of a plant to this firm, which speaks highly for their work and also for the machines used, which have been the improved Excelsior type.

Mr. J. Holt Gates, western manager of the Waddell-Entz Company reports the sale of three large direct connected machines to the West Chicago Street Railway Tunnel Co. These dynamos will be direct connected to J. H. McEwen engines and will run at 275 revolutions. The company are installing two motors with 200 Waddell-Entz copper and steel storage batteries at the Sioux City swing bridge, Sioux City, Iowa. The engineer of the company, Mr. Virgil H. Hewes is now in Omaha for the purpose of installing two 40 k. w. motors with 400 Waddell-Entz copper and steel storage batteries for operating the interstate swing bridge at East Omaha, Neb.

The Central Electric Company, Chicago, recently closed a very large contract for the equipment of the electric light plant of the Michigan State Asylum for the insane at Kalamazoo, Mich. The contract covers 600 electroliers, including sockets, shade holders, etc., 100,000 feet of Okonite wire in sizes from 0000 to 16, and several miles of the company's well known Banner weather proof wire. The contract also includes flush key switches, several hundred dozen shades, and in fact all the supplies required to equip a plant of the size installed. The Central company naturally feels very much gratified in securing this large order, as it was one of 20 concerns bidding on the contract, and the order was placed on the merits of the wire and other supplies.

The Cutler-Hammer Manufacturing Company is the name under which the factory at 241-247 South Jefferson St., Chicago, recently purchased of the Chicago Electric Manufacturing Company by Messrs. Cutler & Hammer will be operated. This factory, with the excellent workmen employed, will give these well known electrical experts unexcelled facilities for the manufacture of electric apparatus. They will continue to carry a full line of the popular C. & H. snap knife switches and automatic motor starters, and are prepared to deliver on short notice anything in their line of electrical specialties. A reputation has been established for designing, calibrating and the manufacture of fine measuring instruments which has brought them a large trade in this work.

The Western Electric Heating Co., Chicago, is to be congratulated upon having secured the services of Mr. Geo. Cutter, as its manager. This Company, it will be remembered, was recently organized in Chicago, for the exclusive manufacture and sale of all kinds of electric heating apparatus, under the patents of the American Electric Heating Corporation of Boston. It is expected to establish a factory in Chicago, although this is a point not yet fully determined. Mr. Cutter is one of the best known electricians in the west, and has always been one of the most enthusiastic promotors of electric heating. Under his management the success of the Western company is assured.

The Western Electrical Supply Company, of Omaha, the announcement of its incorporation recently appearing in these columns, is one of the foremost supply houses of the west. Among the eastern manufacturing companies represented by this house are the Okonite Company, the Interior Conduit & Insulation Company, Hart & Hageman Manufacturing Company, American Electrical Works, Eddy Electric Manufacturing Company and Emerson Electric Manufacturing Company. The officers of the company are as follows: President, W. H. McKinlock; secretary, John T. Burke; treasurer, George W. Johnston. The president is well known to the electrical trade through his prominent connection with supply houses. Mr. Burke for the past few years an electrical engineer and contractor, with an office in Omaha, was previously superintendent of construction for the old Midland Electric Company of Omaha, in which capacity he installed many plants in the west. Mr. Johnston for many years has been connected with electrical interests. He was one of the founders of the Gate City Electric Company of Kansas City, but for several years has been traveling representative for the Central Electric Company of Chicago. Thus the company with such well known electrical men actively engaged in the affairs of the company is bound to succeed. It has already secured a large trade in the south and west and the recent shipment of an entire lighting station encluding the engine, dynamo and supplies to Chichuahua, Mexico, shows something of the extent of the trade the company is already receiving.

The Munson Eagle brand has no piece of leather in its belting longer than 4 feet 2 inches, which shows that only the best part of the hide is used. As this company long since earned the reputation for turning out a purely oak tanned, and what is known as a strictly short lap leather belting it cannot afford to run any risk in cutting into even one-quarter of an inch of the neck portion of the stock; and it is a fact that it is not safe to use more than four feet and two inches from the stock, even if the steer hide be a large one. This dimension is the limit, and if any more is used and the belt shammed by filling or shimming to make an even appearance it cannot, and never will, be a reliable belt and transmit the power the Charles Munson Belting Company's belts have the enviable reputation of doing; and a great many of them are now in use in street railway plants, which preserve such a reputation. Good belts command high prices, but the cheap ones are the dearest in the long run. Margins of profits in all lines are too much reduced to allow of unnecessary cost of maintenance. I was never more impressed with this fact than the other day when I myself was in a hurry and obliged to wait two hours because a nasty, cheap and defective main driving belt performed its "usual trick." If "Munson's" belting had been used the two hours would not have been irretrievably lost.—Francis Holland in Chicago Herald.

ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. November, 1893. NEW YORK. No. 11.

The Department of Electricity.

In January, 1891, Prof. J. P. Barrett was selected chief of the Department of Electricity, and at once gathered about him an efficient corps of assistants. The wisdom with which he selected his staff has never been questioned, but in the struggle to create a department that would be representative of the industry his wisdom was ever apparent. Difficulties were met in the work which at the time seemed almost insurmountable, and which were overcome only by the persistent efforts of the chief and his staff. The formation and construction of an exposition of this character was something that had never before been accomplished, and consequently experience was out of the question in this department. But in order to profit as much as possible by former expositions, Dr. J. Allen Hornsby, who had been selected as first assistant, was dispatched to Europe to visit the Frankfort Exposition and gain as much information as possible from foreign expositions which would be valuable in aiding the department to do the work that was to contribute probably more to the success of the Fair than any other feature. Thus, under the direction of the chief, to whom Dr. Hornsby, the assistant chief of the department, submitted his plans, the Department of Electricity gradually came to maturity. In the accompanying engraving, taken from a photograph by our photographer, we present to our many readers the chief of the department and his assistants. In the February number, 1891, of Electrical Industries, appeared a sketch with portrait of Prof. Barrett, and in the April number of the present year appeared a portrait and sketch of Dr. Hornsby, so that our readers are in a measure familiar with their history. Mr. John W. Blaisdell, general superintendent, has occupied a position which to a less competent person would have been extremely difficult, but his genial manner, especially in handling the allotment of passes, has preserved most friendly feelings. To Mr. W. W. Primm, who, for the past two years has been with the department, occupying the position of electrical engineer, much credit is due to the perfection of the details of the work. Mr. Willis Hawley, the assistant, had previous to his connection with the department an extended experience in electrical work. Commencing with the Western Electric Company, he became familiar with different branches of electrical construction, installation and maintenance.

ELECTRICAL INDUSTRIES

STACEY BUTLER. ORLANDO SHEPARD. GEO. W. MOORE. GEO. J. HENRY, JR.
WILLIS HAWLEY. JOHN W. BLAISDELL. PROF. J. P. BARRETT. DR. J. ALLEN HORNSBY. W. W. PRIMM.

The inspectors of the department are Mr. Geo. J. Henry and Mr. Orlando Shepard, and to their efforts and watchfulness was due the magnificent fire protection of the building. Mr. Frank J. Sullivan and Mr. Stacy Butler have attended to the receipt of the exhibits, and have kept a record of every piece of apparatus installed. Between them they have divided the twenty-four hours of the day so that one of them has been in constant attendance. Mr. Geo. E. Moore has fulfilled the duties of stenographer, which has by no means been a light task. As the department disbands and the members return to their former occupations the goodwill and best wishes of the many friends and acquaintances which they have made in connection with the discharge of their duties will go with them.

The exhibitors in the Department of Electricity met Oct. 30th, and in recognition of the work done by Prof. Barrett, the chief of the department and J. Allen Hornsby, assistant chief, passed resolutions highly complimentary to the efforts put forth by these gentlemen and their assistants during the World's Fair. In the preamble the efficiency of the department and the harmony with which the work was accomplished were mentioned. Copies of the resolutions were ordered engrossed and presented to Chief Barrett and Assistant Chief Hornsby. Mr. John W. Blaisdell has already been presented with a testimonial highly complimentary to his work. Some further recognition of his services is also to be made by the exhibitors.

The Twelfth Annual Meeting of the American Street Railway Association.

The American Street Railway Association assembled in the assembly hall of the Milwaukee Industrial Exposition Building on Wednesday morning, Oct. 18. On the day previous and also during the night the delegates had been arriving from all parts of the country until there had gathered a body of men representing the street railway interests of the United States and Canada. The manner in which they proceeded to the transaction of the business for which they had assembled showed the active interest of all present in the industry. On being called to order Mayor John C. Koch, of Milwaukee, in a short address welcomed the delegates to that city.

In a brief and pleasing manner the president responded to the mayor's address, and then addressed the convention in substance as follows:

Gentlemen of the convention.—I wish to express my gratitude for the honor conferred upon me a year ago by my election to the highest office within your gift and my deep regret that circumstances entirely unexpected and over which I have seemingly had little or no control have confined me in a part of the country far removed from the center of our business interests, and so much of my time has been necessarily devoted to other business interests of a personal nature and of vital importance to me that I do not feel that I am fully in touch with the affairs that have brought us together at the close of one of the most eventful years in our history as an organization.

The hundreds of millions of dollars interested in urban and suburban transportation will always be a safe investment; if, in our enthusiasm we have sometimes over-discounted the future we have only to wait a little longer period for the dividends which are sure to come. Financial panics through which we are now passing are of irregular occurrence, yet they are sure to reappear, affecting receipts and making economies of management a subject of deep study. In my experience covering a period of nearly thirty years, I have found it better to keep up the quality of service at such times even at the expense of the dividends for the time being; the public by a more liberal patronage will eventually more than make up the loss which would follow on the heels of a reduced and debased service; the faithful employe and the road bed and equipment should be the last to suffer.

Economies should begin in other directions—in the purchase of supplies, in better methods of work and in improved appliances, aiming always for the best service at the least possible cost; and that, gentlemen, is the fundamental principle of the prime reason for our organization; and that is why, in just such times as we are now passing through we should see if some plan cannot be devised which will increase the usefulness of our association. One such plan was proposed by me a year ago and was referred to the executive commitee; after a careful consideration of the matter the committee decided to give an object lesson of that plan at this time and therefore arrange for an exhibition on a grand scale of all the appliances used in our business.

While the unusual financial stringency and the special exhibits at the World's Fair have served to detract very much from the completeness which we had hoped for this exhibition, yet it will be sufficient as an indication of what might be expected from a continuous exhibition of the kind. Thanking you for your kind attention and giving you each a hearty welcome and a God-speed we will now proceed with the regular order. The report of the executive committee.

The report of the executive committee showed that after numerous consolidations the present membership of the association was 200 members. It considered at some length the formation of an American Street Railway Industrial Institute and submitted a proposed act of incorporation. The committee did not consider the present time favorable for the formation of an institute and requested that the subject be continued with the committee for another year. It also took occasion to congratulate the inventors, manufacturers and all others who had contributed to the street railway part of the Columbian Exposition in both the departments of transportation and electricity, and also congratulated the Exposition authorities on their success in having given to the world and especially to the United States the greatest fair the world has ever seen.

To the memory of James W. Hyatt, of Norfolk, Conn., Geo. D. Capen, of St. Louis, and Edw. E. Dennisten, of Philadelphia, a fitting tribute was paid by the committee.

The report of the treasurer showed the receipts during the year had been $8,765.77 and that the expenditures during the year were $6,541.48, leaving a balance in the treasury of $2,222.29.

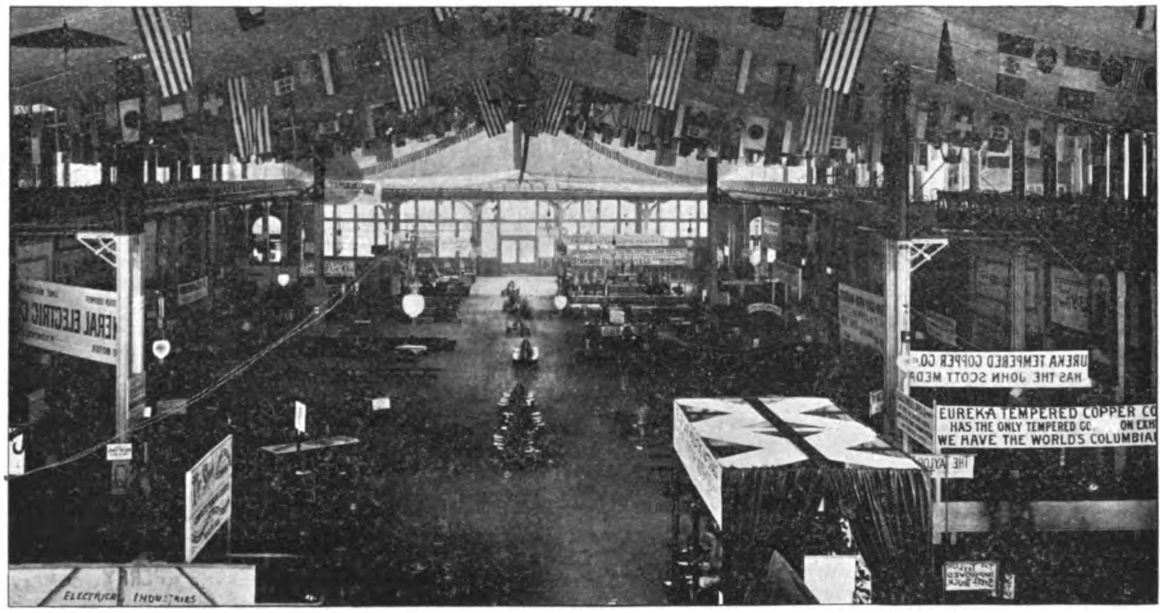
The balance of the day was occupied in listening to the reports on Power House Engines, an abstract of which appears in this number with the discussion which followed. Thursday morning the convention listened to a paper on Storage Batteries in Connection with Central Stations for Utilizing Surplus Energy for Lighting and Power, by Mr. C. O. Mailloux, in which a great deal of interest was taken and considerable time was occupied in the discussion of the subject.

On Thursday afternoon a paper on Direct Driven Generators, by C. J. Field, was read, which was followed by a short paper read by W. E. Harrington of Camden, on Magnetic Cut-outs; after which Mr. Lang, the chairman of the nominating committee, reported that the committee recommended the following officers: president, Henry C. Paine, of Milwaukee, Wis.; first vice-president, W. J. Stephenson, of Washington, D. C.; second vice-president, James R. Chapman, of Grand Rapids, Mich.; third vice-president, Louis Perrins, Jr., of Trenton, N. J.; and secretary and treasurer, W. J. Richardson, of Brooklyn, N. Y. The committee also recommended Atlanta, Ga., as the next place of meeting; all of which report was unanimously accepted and the officers elected.

By the request of the president, Mr. Herbert Claude, of Washington, D. C., gave some interesting information in regard to the conduit trolley system used in connection with an overhead system in that city, in regard to which he said in substance as follows:

"We had already laid about a mile of track in the city when we found we could not put up our overhead poles. The question came up right away what were we to do and what system to put on the track. We had the Buda Pest system, the storage battery system and the cable system before us. We did not think the storage battery possible for the simple reason that we would have to have a new power house and new car house. With the cable system we did not think with our traffic, which was light, that it would pay to expend 80 per cent for hauling rope and 20 per cent to haul passengers. We determined on the underground system and went to the best electricians for their opinion. We were told that electrically it was all right but the principal trouble had been in the construction. We thought we could overcome that, and undertook the construction.

"We put down one mile and a half of track and have had it in operation since March 4th last. It runs on the outskirts of the city and there joins to the overhead trolley. We know it is a success and see no reason why if it will run for a mile and a half is should not run for any distance. The current is the same and I do not consider it anything new. It is simply the overhead system underground." In reply to the question, "Have you operated the road during cold weather?" Mr. Claude said: "During March we did not have any very cold weather, but had some snow. In the overhead system the return current comes back through the rail. If it is covered with snow and ice it gives a good deal of trouble. This underground system does not give us any trouble in that way, for the current is returned through the wire in the conduit. In regard to the conduit filling with snow I do not think that there is any chance of its filling completely. It can be looked after just as the snow is looked after on top. I run a sweeper through it once a week, and every hundred feet there is a manhole and a trap and this dirt drops where it is easily removed. Mr. Law, who has charge of the construction, can explain as to the manner of construction and how the trolley wire is suspended."


ERAL ELECTRIC
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ELECTRICAL INDUSTRIES

VIEW OF EXHIBITS IN EXPOSITION BUILDING, MILWAUKEE, DURING THE CONVENTION.

Mr. Law gave a short description of the construction, of which the following is an abstract: "The Love underground conduit consists of an iron yoke weighing about 360 pounds each, with an opening 14 inches wide by 20 inches deep. This yoke has square ends to support the rail, and is embedded in concrete, so that the entire track construction is extremely solid and rigid. Again, the shallow depth of this yoke removes the necessity of moving gas and water pipes, which, you all know, increases the cost of construction in cable railway work to a great extent. In other words, we just climb over the top, and still have a large enough conduit, by sweeping, as Mr. Claude says, to keep it clear of all refuse and snow. The slot rail that is attached to this yoke is made of steel, and is made V-shaped, having a side bearing of an inch and a half, and projecting into the conduit five inches on the inner side. The insulator is attached to the yoke upon shouldered bolts, and the insulator is allowed to remove about two inches and a half laterally, to allow for expansion and contraction. Any expansion or contraction in the rail will not affect the insulator. That is placed under the slot rail, allowing a quarter of an inch air space. I have been repeatedly in the conduit and have been unable to burn a candle in it, on account of the extreme draught. There is a constant draught around the insulator, which prevents any collection of moisture. In the stormiest weather you can take off the slot rail and find a dusty insulator. The slot rail is so attached to the yoke that by removing the bolts in the yoke we can remove the slot rail and get ready access to the rail for any repairs that may be necessary. The trolley carrier is fastened underneath the cars, and is so arranged that as the car is moving in this direction it will drop into a V-shaped slot, and this end of it is allowed to move back and forth to provide for the irregularities in rounding curves.

As the car is rounding a curve you cannot detect it by being in the car and looking at the trolley that it is on the curve. The trolley is made of half-inch steel, four and one-half inches wide, with two trolley arms on the bottom suitably insulated. It is shaped in the center to allow the wheel to move sideways, so that if the wire is not exactly straight if it should happen to be further away than is proper, the wheel will move sideways far enough so that the trolley will remain on the wire. It has an elbow movement to facilitate the rounding of curves. It is impossible for the wheel to leave the wire at any point. We have run the road through all the different weather that we have experienced in Washington. We had quite a severe snow storm in March last, but we had no snow inside the conduit at that time, nor do I anticipate any trouble whatever from snow if the conduit is properly taken care of, simply running the broom through it once a day. It can be run through without any delay and keep the conduit free from snow."

By a motion the convention expressed its thanks to the Milwaukee Street Railway Company and the various enterprising men in the city who had extended special invitations, for the kind and hospitable treatment while the convention was in session, after which the convention adjourned.

The Use of Storage Batteries in Electric Generating Stations for Utilizing and Regulating Power.*

BY C. O. MAILLOUX.

The diffidence with which I entered upon the task of preparing a report on the above subject for this Association is sufficiently proven by the fact that I made a couple of unsuccessful attempts to decline the honor. My excuses and objections, however, availed me little with Mr. Longstreet, your honored chairman, who soon had me enlisted.

The question is not without some importance at the present time when power stations are multiplying and growing so fast as in this country, because this question is one that has an important bearing on the design of the station; since, if this use of storage batteries is really feasible and practicable, in the full commercial sense, its utilization with a view to securing the full measure of its benefits and advantages would, in many cases, involve somewhat radical changes in the arrangement of the power station and possibly even in the details of its operation. In Europe the use of storage batteries in central stations has unquestionably made great progress during the last three years, and has actually succeeded in commanding the respect, if not entirely overcoming the scepticism of electrical engineers generally. The irregularities of load, on power circuits, especially for electric traction purposes, are the bane of the electric railway engineer; and they are too well known and understood to require further mention now, except to classify them; for, in reality there are two kinds, which must be carefully distinguished from each other, almost as if they constituted distinct diseases, so to speak, requiring different treatment, even though they may appear together in the same case. We must, therefore, distinguish between "variations" and "fluctuations" of load. I would use the term *variation* to designate the effect caused on the station plant by putting on or taking off a certain number of cars; and the term *fluctuation* to designate those incessant erratic ebbs and flows of current which are so familiar to us all, due to the starting and stopping of cars, changes of speed, grades, etc. The variations of load are defined as changes in mean or average rate of production for a given period of time; the fluctuations of load are defined as changes in the rate of production from one instant to another.

These fluctuations cost the railway companies money in three ways. First, because they involve the use of generating machinery of greater capacity than would be required if the machinery were operated at a constant uniform load; second, because the depreciation is greater; third, because the efficiency of the machinery is lower. The first two points are well understood. The third requires a slight analysis. The use of engines and dynamos greater than would be required for the mean load increases the percentage of energy spent in the engine and dynamo to overcome friction and also to energize the field-magnets as the friction load and magnetizing energy (neglecting hysteresis and Foucault currents) must of necessity increase with the size of engine and dynamo. Results show that by the time the load has fallen 40 per cent. the efficiency drops very rapidly.

Now, considering a little more closely the engine itself, several authorities have called attention to the extreme variations in steam consumption per indicated horse power at various percentages of load, which is the real measure of the engine proper. Cases are not rare where the use of engines too large, but rendered necessary owing to severe fluctuations to be compassed, have consumed from 10 to 15 per cent. more steam than they would at normal constant load. The total loss, of course, includes the loss in the engine cylinder as well as that due to mere friction. If the steam consumption is, say 20 per cent. greater than it should be per average indicated horse power, and if the engine and dynamo utilize 15 per cent. less of the indicated power than they would if of more suitable size and running under better conditions, the next efficiency will be the product of these two factors; or we might say in this case that only about seven-tenths of the steam utilized. This means that if the steam could be properly utilized it would do some 40 per cent more work.

It is for the purpose of better utilizing and economizing this power that the storage battery is proposed to be used, by taking advantage of its property of being able to "give and take" energy, and thus keep the load balanced and equalized at all times. The principle of its action is that it can be made to absorb energy from the circuit (or the dynamos) or give it back in any desired amount, so that absolute control may be had of the total load imposed on the generating machinery independently of the rate at which the energy is consumed.

USE IN LIGHTING STATIONS.

The use which has already been made of the storage battery for regulating the load in the central stations for electric lighting service is quite extended. It is thought that a brief reference to some of them will be of interest and utility.

There is only one case in this country (besides the 53rd Street Edison station N.Y.), namely, the Edison station at Germantown, Pa., where storage batteries are used as load equalizers. The total capacity there is of about 1,000 ampere hours, made up of several series of small cells connected in multiple. The battery is charged during the six or seven early morning hours when the outside load is very light. It stands idle during the heavy load in the evening and is discharged to carry the load after the plant shuts down. In this case the battery saves the expense of running the plant during the period of small load. Additional capacity is contemplated by the company and will probably be put in this winter.

A large battery is being installed at the Central Edison in Boston. This battery, of German manufacture (Tudore) will be by far the largest in this country, the cells being over twice the size and capacity of the battery of those in the 53rd Street (New York) station referred to above. Its adoption was decided upon after a special study made of the use of storage batteries in European central stations, by Mr. C. L. Edgar, the superintendent of the company. The Brooklyn (N.Y.) Edison station has also in contemplation the use of a similar battery.

It is in Europe, however, that the use of the storage battery in central stations has made the most headway.

In the city of London alone there are no less than eight stations supplying current for lighting, in which storage batteries are depended upon for part or the whole of the load carried. The aggregate actual capacity of these stations is some 200,000 lights (sixteen candle power). In many cases the batteries are not located in the generating station, but at sub-stations suitably located with reference to the consumers. The charging current is sent to the batteries at high potential, several sub-stations being joined in series for the purpose of charging.

In Paris there are some twenty or thirty such sub-stations located in various parts of one section of the city, and all charged from same central station.

The experience had in America with storage batteries would naturally lead one to expect that very radical improvements would be necessary to render these extended applications feasible and successful.

The close study and analysis of the evolution which the storage battery has undergone under European auspices indicates, however, no evidence of any great radical departure in principle or construction. The results attained seem rather to be the fruit of a thorough, comprehensive study and appreciation of the frequirements of the cases, where they are to be used, of the limitations of the batteries themselves, and of the conditions requisite to make their employment successful. It must be admitted that the conditions are eminently more favorable in the case of stationary batteries than in the case of portable or of traction batteries to be carried by the cars themselves; for the limitations of size and weight in relation to capacity are not serious or do not exist at all, to say nothing of the advantages realized in other respects. It is recognized, as a condition of success by Europeans, that too much must not be expected in these respects, as too frequently has been the case, and that the principal objects to attain are long life and high efficiency, even at the expense of increased first cost. Instead of attempting to obtain ten ampere hours per pound of battery element, the manufacturer limits himself to two, three, or at most, four. This makes a greater proportion of grid or frame to active material; but it also adds to the solidity and endurance of the battery.

The Planté process of formation and its modifications would seem to have proven itself superior to the pasting or Faure process, if one can make a criterion of the fact that at least nine-tenths of the aggregate of the central station batteries used is of the Planté type, or some modification thereof. The Planté batteries are conceded to be, usually, of lower capacity per pound: but on the other hand they have the advantage of being able to carry heavier rates of charge or discharge. The battery plates are made of much larger size than usually made in this country, and only a few sizes (often only one) are made; the various capacities of cells being made up by adding the requisite number of plates. This simplifies the matter of extension. The cells, usually made of tarred wood lined with lead, may be provided larger than at first necessary; and, as required, more plates can be added to each element to increase its capacity. The practice of coupling separate groups in multiple is not much followed, and in fact is usually condemned, although there is no reason why it should not succeed when suitable means are provided to insure proportional action in all groups at all times.

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*Abstract of paper read before the American Street Railway Association at Milwaukee, Wis.

There is probably no storage battery cell on the market, of American manufacture, having as much capacity as 500 ampere hours. In Europe they can be procured up to five thousand ampere hours capacity. A cell of the latter capacity, weighing complete some 4,750 pounds size and about 36 by 39 ins., height about 40 ins., gives an idea of the scale on which the storage batteries in European central stations is carried on. It may be added that a further idea of the scale of operation is obtained by examining the plans of central stations such as that of Hanover, where a separate building with four floors about 70 by 35 feet is reserved for the storage batteries. The capacity of the batteries is rated on a more scientific and rational basis than has been the custom in this country. It being a well-known fact that the capacity is lower when the discharge rate is increased, the practice is adopted of giving the capacities which the same cell will give under different rates.

Your committee, however, thinks that the most satisfactory report on this point is to refer to the results obtained in actual practice covering long periods.

At Lyons, for a period of one month, the efficiency obtained by measuring with a watt meter the energy spent in charging, and the energy drawn out from the battery was over 85 per cent. In Hanover the efficiency of the battery for one entire year, measured the same way, was 78.4 per cent. At Dessau (Germany) the efficiency for a year was 78 per cent. In the 53rd Street station the watt hour efficiency has been over 85 per cent, the percentage which was guaranteed by the Crompton-Howell Company.

It is conceded by all authorities that an efficiency of 75 per cent can be expected of such batteries, and that under normal conditions it may reach 80 per cent. or more.

It is proper to distinguish between the station efficiency and the battery efficiency. for a battery loss of 25 per cent does not necessarily mean a loss of 25 per cent of the whole power. If the battery, as in most cases, supplies only one-fourth, or less, of the whole output (in watt hours) it is that portion alone which the loss of the battery affects. Even in Hanover where the proportion of the battery output is comparatively high, (53.6 per cent of the whole) the total loss entailed by the battery is only 9.4 per cent of the whole energy produced by the plant.

The Electric Storage Battery Company, of Philadelphia, which is about to put on the market some large central station cells (up to four kilowatt hours) of a type already in extensive use in France, informs me that it expects to reduce the cost to $25, f.o.b., per kilowatt hour capacity. The total cost, erected, would be from $30 to $35, according to distance, etc. The cost of imported batteries, erected, would probably range, according to size, from $40 to $65 at the present time.

The maintenance is generally guaranteed by the manufacturer for a fixed annual percentage. At first this percentage was as high as 10 per cent. It was found, however, as the result of improvements that this percentage could be reduced safely. The present ruling cost of maintenance is about 5 per cent per annum for a ten year guarantee. In every case it is stipulated that the battery will be put in as good condition at the end of the ten years as when first installed.

Mr. W. S. Barstow, superintendent of the Brooklyn Edison station, who visited several battery stations in Europe, has informed me that in some instances the lighting company has found that it could itself undertake the maintenance, and effect a saving, which fact he was allowed to verify by access to the accounts, the cost being in some cases as low as 4 per cent for a period of several years. The tudor battery, installed in the Edison section already referred to, is stated to be under a ten year guarantee at 3.5 per cent per annum. Mr. Pakenham has given me figures for some Crompton-Howell installations, where the cost of maintenance was only about 4 per cent. There being no instance of a storage battery used in railway stations the cost of maintenance under the conditions which obtain there, cannot be ascertained, and can only be conjectured. It would appear, from consideration of the new conditions involved, that the depreciation must necessarily be greater; and that not less than 12½ per cent, or even 15 per cent, should be taken provisionally as the estimated cost of battery maintenance in railway power stations.

The gain from increased revenue, by the use of storage batteries, is effected in cases where the supply of power is continuous but limited, usually water power, but also in the case of gas engines, which, it may be said by the way, are coming into use in central stations in Europe, particularly in Germany. In the case of water power, the storage battery enables the power of the whole twenty-four hours to be prepared so as to be ready for delivery during the comparatively short period of full load, if desired.

In all of the above cases, the cost, efficiency, depreciation, etc., of the battery, on the one hand, and the value of the benefit to be derived must be carefully weighed, in order to determine the relative size, etc., of battery that is best suited for the purpose, it being evident that where power costs little, the loss in the battery, for instance, is of less consequence than where power is expensive.

APPLICATION TO ELECTRIC RAILWAY POWER STATIONS.

The abundant evidence which your committee finds of the usefulness of storage batteries in central stations for electric lighting, makes it natural to presume that they can also render good service in electric railway power stations. Your committee had hoped to be able to present at this meeting some practical results tending to show whether or not this presumption be warranted, but no amount of argument or persuasion has availed with the street railway managers who were approached, so great is the disrepute into which the storage battery has fallen in this country.

The use of storage batteries is destined to important application where water power is used for railway power generation. In such cases, since the power costs relatively little, the gain in efficiency is not of so much moment as are the regulating quality and the ability to store energy. Where the supply of power is constant but limited, the rate of consumption can never exceed the rate of production. The consequence is that in railway water-power stations either the potential fluctuates seriously or else a sufficient margin of available power must be allowed, which means that the power cannot be worked to the limit. With the storage battery, not only the turbine can be loaded to the full limit, but the load may even be greater if there is sufficient time in the interval between heavy loads to accumulate a reserved power in the batteries.

The process of making storage batteries absorb from or give back to a circuit any desired rate of current consists merely in varying the working potential of the battery in relation to that of the dynamos or circuit to which it is coupled, the same as a load can be divided up in any desired proportion between two dynamos coupled in multiple by simply varying their E.M.F. relatively to each other. In the case of storage batteries, unfortunately the working E.M.F. is not the same when charging as when discharging; nor is it the same for different rates of current, or even to the same rate at various periods of the charge or discharge; hence constant adjustment is necessary. In lighting stations the desired relation of working potential to control the charge or discharge is effected usually by putting more or less cells in circuit. This method would be inadequate for the fluctuations met with on railway power circuits by reason of its lack of quickness and of flexibility. The means provided must be such as to make the change of relation adapt itself to every change of load automatically, instantly and to any desired degree.

This can be accomplished by introducing in the battery circuit a variable source of potential, such as produced by a small dynamo, to which the name "booster" has been given. The working current sent over the line passes through the field magnet coil, being suitably proportioned by a shunt, and thus enables the fluctuations of load themselves to control the working potential of the batteries, so as to produce any desired relation.

It makes little or no difference in the compensating action of the batteries whether they be coupled to the circuit of the station or at sub-stations located at various points at a distance from the station. There would result from the use of sub stations a greater uniformity of potential over the whole system and a saving in copper; but one must offset against this the extra cost of the space, the extra attendance and expense of sub-stations. They may be warranted for this reason only in very large systems covering large and relatively distant territory, also in inter-urban lines.

In conclusion, the investigation and study by your committee of the facts and data bearing on this subject, as outlined herein above, would seem to your committee to warrant the following conclusions:

1. Great progress has been made in Europe during the last two or three years in the manufacture and perfection of storage batteries suited for central station purposes.

2. Storage batteries have been introduced in a large number of electric lighting central stations on a large commercial working scale as factors of reserve and regulation, with a view to securing economy of initial cost and cost of operation, with satisfactory financial results as a general rule, which has few, if any, exceptions so far as your committee could ascertain.

3. The benefits derived from lighting central stations from the judicious use of storage batteries are so valuable in individual cases that the possibility of attaining like benefits, even to lower degree, in railway power stations, would justify the investigation of their use by actual experiment where this can be done under favorable conditions.

4. While the conditions differ and are essentially more severe in railway power stations, there is no reason apparent why storage batteries may not be used successfully and advantageously for the purpose of securing greater uniformity of potential at the station or on the line, or of promoting and improving the efficiency of the plant.

5. Even assuming the highest values for initial cost and depreciation of the storage batteries, the indications point to the possibility of realizing a gain in economy in all stations operating 200 cars and less, when coal is worth $2 per ton and over, while the economy will be much greater should the initial cost and depreciation prove actually lower in practice. Advantages are also secured which, though not effecting economy directly, do so indirectly by affording additional convenience in operation.

6. The indications are that in some cases a power plant could be built and operated at less cost by using storage batteries than without.

7. The capacity of an existing plant can probably in most cases be increased more cheaply by adding storage batteries than by adding more generating machinery, while at the same time the cost of operation will be reduced.

8. The question whether the storage batteries are expedient and practicable and to what extent, or any particular case,

should be and can only be, in the present state of our knowledge, determined for each case individually by a careful analysis of the facts and conditions involved by a competent engineer.

9. Practical experience in a certain number of stations alone can lead to definite rules or indications in regard to the best size of the battery, the best methods of regulation, the most favorable conditions of use and like questions.

10. Perfection in the details of the use of storage batteries in railway plants will be the result of a certain evolution, or series of improvements, same as in other details of the equipment of a plant.

Street Car Magnetic Cut-outs.*

BY W. S. HARRINGTON.

The definition of a magnetic cutout is a cutout which opens the circuit instantly at a set strength of current. The magnetic cutouts most familiar are those used on switch boards in power stations, and embody in all instances the long throw switch to break the violent arcing which always ensues upon the breaking of the circuit. Carbon points are sometimes used to take the final and most destructive sparking. On all the forms of cutouts as above described, considerable care and repeated cleaning of the switch is required, owing to burning of little fused teats on the knife blade or jaws of the switch. The switch also occupies considerable space, as well as being quite expensive. All these reasons militate seriously against the use of such magnetic cutouts on local car or motor circuits.

The only protection used now on our local car or motor circuits is a fuse. The definition of a fuse by a fuse manufacturer is "Fuse wire is a safety device designed to break the electric circuit when an excessive circuit passes, and it breaks the circuit because it is heated to a temperature at which it melts." The fusion necessarily depends upon all the elements that effect this heating, it takes time to heat even a wire. A fuse has another property which has never received the serious attention that its importance demands, to-wit: -the passing of currents momentarily far in excess of its rated fusing or blowing capacity.

It is in this latter property that we have all suffered at times—which in our power station work preemptorily demanded the abolishing the fuse cutout, and substituting the more positive and reliable magnetic cutout. And if the magnetic cutout as used to day could have been adapted from both the practical and cost standpoint to car work, we would be over the occasional vexatious troubles incident to street car operation by reason of the irreliability of the fuse.

To illustrate what is meant by our statement of the irreliabiliaty of the fuse—the ordinary street car of to-day will take current sometimes as high as 100 amperes, but with an average current of about 25 amperes. The usual custom is to place a 50-ampere fuse in the motor circuit for its protection. Now what results if a wire, coil, armature or any part of the motor circuit is grounded or short-circuited with a consequent abnormal rush of current. In practically every instance momentarily the fuse will carry 2-3-400 amperes without blowing. But with the result of opening the magnetic cutout at the power station, controlling the division on which the disabled car is, this naturally affects every car on that division.

This trouble continues until the disabled car is found and removed from service. Whereas, if a simple, cheap, reliable magnetic cut out were placed on the car, the opening of the magnetic cutout at the power station, as described above, would not have occurred, as the local car circuit itself would have been opened.

The petty troubles arising occasionally on local car circuits are of such a character that we are as liable to their repetition as we are to the occasional hot crank pin on our engines; we cannot prevent insulation from falling, wires from breaking, or careless employes leaving car brakes set. These are troubles we will always be subject to, no matter how careful may be the design and manufacture of our apparatus. It is therefore exceedingly important that, as our systems are increased, our lines extended, that this real and most exasperating of all defects, the stoppage and crippling of an entire line or division, by reason of failure of a single motor equipment should be remedied by confining the stoppage to the immediate unit or car. Another trouble of serious importance is the possibility of fire, the burning and damaging of cars by reason of fire. Many cases of fire in cars, due entirely to insufficient protection, have been recorded during the last few years.

It has been urged that a magnetic cutout is too sensitive, and this sluggishness of the fuse is desired for street car work. This is admitted as far as the regular range of variation is concerned. For instance, you know that on your road, with your cars, the extreme maximum limit of current, even momentarily used, is say 100 amperes. Then set your magnetic cutout to open on the passage of 125 amperes. Your fuse does not protect, although rated at 50, and will momentarily carry 400 amperes, whereas the maximum increase on your local car circuit, with the magnetic cut out, cannot exceed 125 amperes.

It has been raised as an objection that a magnetic cutout is not a necessity,—that the failures on local car circuits are so seldom that we do not need it. I think if every railway manager will recall the occasional interruptions on one or more of his different divisions, with the report handed to him that cars cannot run owing to there being trouble on that division, which has to be hunted for and removed, will agree to class the magnetic cutout among those other safety devices such as lightning arresters, safety valves, etc.

The magnetic cutout which is herein referred to, differs radically from all other types of cutouts, and it is in this radical difference wherein the cutout is cheapened and adapted to street car work. There is no heavy, long throw switch and there is no arching, absolutely none, at the main switch when it opens, as all the energy and what would otherwise be destructive sparking, is dissipated in an exterior hermetically sealed chamber.

Power Plant Engines.*

BY E. G. CONNETTE.

The subject represents the vital part of a street railway; as the heart forces the life current through the arteries of the body, and an impairment or weakness of this vital organ will produce impaired health, so also is the power house engine the vital part of the street railway, as it produces the power that creates and forces the electric current through the arteries (the trolley wire) of the electric railway, and, like the heart, if the engine regulates badly, it produces a bad circulation of varied potential, which impairs the service of the road.

Good service, and uniform speed of cars can only be maintained by a constant, unvarying potential, and in order to do this the engine must regulate practically perfect, so that there will be no variation of speed as the load varies. The varying power required on an electric railway is unquestionably considerable, caused by cars constantly stopping and starting; going up and down grade, rounding curves, using resistance in order to run slow through crowded streets (which necessarily increases the load) and in order to have perfect service, and uniform speed of cars, the engine must be constructed so as to maintain a constant and uniform speed under any variation of load. This variation of load amounts to a very considerable fraction of the whole maximum load; in small plants it may reach 95 per cent of the maximum, and in large plants is frequently 50 per cent.

If the speed of the engine decreases when a heavy load comes on, the potential is reduced, which consequently reduces the speed of the cars, heats the car armature, and creates an extra strain upon the machinery, which of course means an increase in the consumption of fuel, and in various other ways produces imperfect and expensive service. If the speed of the engine increases, when the load diminishes, it consequently increases the voltage or potential, which is liable to result disastrously to the generators and car motors. Moreover if the engine regulates badly, and the load diminishes suddenly, the engine is liable to "race," which is nearly always attended with more or less disastrous results.

The governor, or regulator, to be mechanically perfect should be made of the best material and workmanship, and should be so constructed as to control the engine under any variation of load, with a variation of speed not to exceed two per cent. An engine that will regulate within two per cent is practically perfect for street railway work, though there are engines on the market that, on electric railroad service, can be held to one per cent deviation from the mean.

We are so accustomed to consider the reciprocating engine as the only steam motor within our reach, that it is not surprising that a new form of steam motor should have quietly been developed without our notice. The committee refers to the steam turbine, one form of which, the Parson's steam turbine, has recently been subjected to vigorous and searching trials and tests by Prof. A. D. Kennedy, of London, England, who has developed power at the rate of $20\frac{3}{10}$ pounds of water per electrical horse power per hour in a turbine using steam at 97 pounds per square inch, and making 4,600 revolutions per minute, the turbine having a capacity of about 165 horse power. The small size of this motor, absence of reciprocal motion and consequent independence of heavy foundation, high speed of rotation, and consequent availibility for gearing direct to generator, simplicity of construction and consequent low cost, and its very high efficiency as a motor, all tend to make this a strong rival to the reciprocation engine as a steam motor for electric power and light stations.

The loss of power between the engine and switch-board terminals is from 15 to 25 per cent, which is attributable to the inefficiency of dynamos, and also to the friction of countershafts, belts, idlers and attachments, which are simply power consumers, representing a waste of power without any resultant benefit. Besides the loss of power, the expense of maintaining the various arrangements for the transmission of power is quite considerable. The waste of power can be overcome by connecting the generator direct to the shaft of the engine. While machinery of this class is more expensive than the other because it demands a slow speed for the generator, necessarily increasing its size, the saving in power and the maintenance of the machinery of transmission will be sufficient to compensate for the slightly reduced dynamo efficiency, due to slower rotation, and will warrant the recommendation of the direct driven equipment for moderate or large sized plants. The direct coupling of engine and generator gives also an important advantage particularly in the large stations in crowded cities, by the considerable saving in floor space.

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*Read before the American Street Railway Association at Milwaukee, Wis.

*Abstract of paper read before the American Street Railway Association at Milwaukee, Wis.

The committee look with favor upon compound engines for street railway work, especially so with engines having ranges to cut off wide enough to keep the low pressure cylinders ever from expanding below atmosphere. When this is the case, there is no doubt that the compound engine is very economical as it carries the expansion of steam to a greater limit. Where it is possible to condense in connection with the compound engine, there is not the slightest question as to economy. In fact where condensing is possible, there is no reason why the expansion shoula not be carried to a further limit.

Ordinary consideration of economy in labor account will dictate the use of labor saving appliances and methods about the boiler house and engine room; a feature frequently omitted, owing to a lack of appreciation of its value as a labor saving and a safety appliance, is a light overhead traveling crane with differential pulley blocks for handling armatures, cylinder heads, and other parts of machinery.

The practice occasionally followed of placing the generators in the second story of the power house, is not to be recommended, even where floor space is difficult to secure. The difficulty of securing for the dynamos rigid foundations, and the resultant evils of increased frictional losses and heating, will generally render this disposal of plant inferior to placing the dynamos on rigid ground foundations, even if the problem of floor room has to be settled by direct coupling of generators to the engine or the incurring of considerable outlay for additional ground room. The plan adopted at the power station of the West End Company in Boston, of sinking the countershaft into a basement pit, keeping the generators on the same floor with the engines is worthy of consideration for extraordinary large plants as securing rigidity of foundations, necessary belt lengths, economy of floor space, without going to direct gearing of generators to engines.

When electric traction was first introduced for street railways, engine builders were not cognizant of the actual require ments for this kind of service; they did not anticipate fully the extraordinary variation of load and the liability of a short circuit, which so severly tests the strength of an engine. Engine builders, however, are endeavoring to overcome mistakes which were made at the outset by strengthening and making all of the parts more durable and to make such improvements as will meet all the demands for this extraordinary class of work.

When electricity was first intuoduced as a motive power for street railway transportation the largest types of generators were small units as compared with those manufactured at the present time, and, as a rule, high speed engines from one hundred to two hundred horse power, belted direct to the generator, were in most cases adopted without regard to the size of the plant. In some instances Corliss engines were installed and the dynamos connected to countershaft. In nearly every installation mistakes of more or less proportion were made, not due, however, to the fault of the street railway people, but the lack of knowledge on the part of the manufacturer as to what was actually necessary to properly fulfill the requirements of the new field of traction. Local surroundings and conditions will, to some extent, govern the division of power into units, but, as a rule, the following principle will be safe to follow: The size of the proper unit of subdivision should be such as to give the required relay or reserve above the maximum power adopted.

In selecting a type of engine, the size of the installation must largely govern, as well as local conditions, such as water supply and price of fuel, though some consideration may be given to opportunities for station room and arrangement. For small plants to run ten or fifteen cars, simple high speed engines, belted direct to generators are unquestionably the proper choice. For twenty to fifty car plants, compound engines, with condensing apparatus where it is possible; with tandem compound engines for the smaller plants and cross compound engines for the larger ones, geared direct to generator, will probably be found most economical. While for the larger systems compound or triple expansion condensing engines, using steam at a high initial pressure and either driving a countershaft or coupled direct to generator, whichever the conditions of the case will warrant, will be found a proper selection. In every case, except for small plants, where engines are belted direct to generator, the vertical type of engine is recommended.

In conclusion, the committee desire to impress the importance of keeping the steam plant as near as possible to the conditions that exist when the engines are installed and being run under the supervision of the mechanical engineer who installed the plant. This, perhaps, is of as much or more economic importance as the design of the engine, as the plant is then run by the expert in chorge with a view to attain the highest degree of efficiency and economy.

The Beloit Electric Light & Power Plant was recently purchased by Mr. Guy L. Cole formerly a resident of Fort Atkinson, but now of Beloit.

The Accident at the Power House of the Atlantic Ave. R. R., Brooklyn, N. Y.

An accident which was very disasterous in its results occurred on October 11th, at the power house of the Atlantic Ave. R. R., at the corner of Third Ave., and Second St., Brooklyn, N. Y. It was about 7:20 in the evening when it became apparent to the engineer in charge that something was wrong with the engine or generator of the combination known as No. 2, and a minute and a half or two minutes afterward the great fly wheel of the engine burst. The pieces flew in each direction tearing a great hole through the roof and each of the side walls of the power station.

The accident immediately stopped the machinery at the power station thus disabling the entire system of the road. Power was secured from the Brooklyn City Railway and after a delay of two or three hours the lines were again in operation. The power house contained seven 700-horse power tandem compound engines and one 400-horse power engine each belted to an electric generator. The fly wheels weighed some 20 tons and the havoc caused by the bursting of one of these wheels is shown in the accompanying illustration. The engines were run normally at a speed of 82 revolutions per minute. The cylinders of the engines are 20 and 36 by 48 and the steam pressure was 140 pounds.

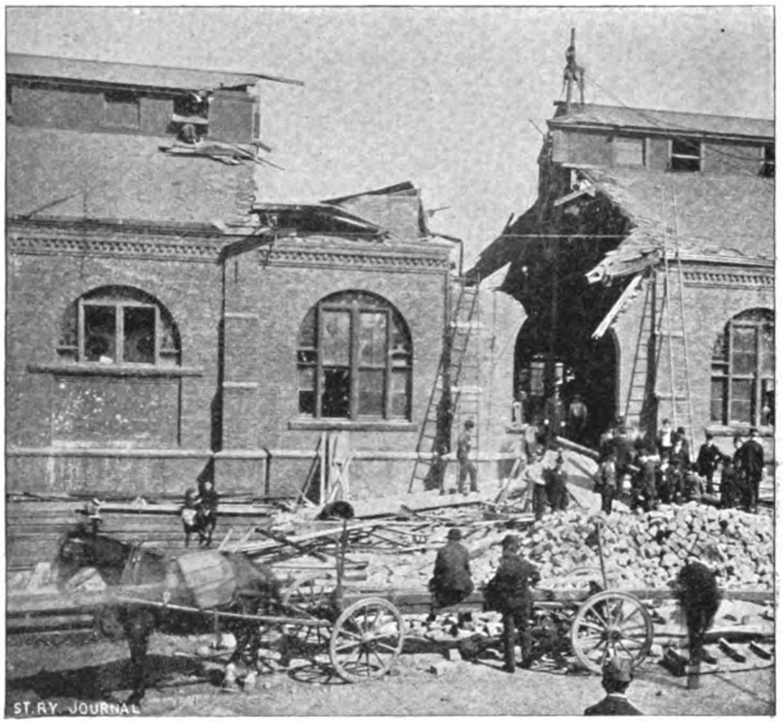


FIG. 1.—ACCIDENT AT THE POWER HOUSE OF THE ATLANTIC AVE. R. R.

In his account of the accident the engineer in charge of the station says that his first intimation that anything was wrong was when he noticed that the speed of the engine was greatly reduced and was so slow in fact that he was afraid the governor would descend so as to cut off the supply of steam. In order to prevent this he raised the governor by means of a device which is used for sustaining the governor when the engine is started. He then heard a loud report and immediately noticed that the commutator of the generator was sparking so badly as to seem a circle of fire. After pulling out the negative circuit breaker he motioned for the assistant to close the circuit breaker on the switchboard. The speed of the engine increased and he began to close the throttle valve which was found closed and badly bent after the accident. While he was thus engaged there was another dull report and his impression was that the pulley of the generator had broken. After closing the throttle he hurried out of line of the engine but not soon enough to avoid being struck. He was struck probably by the belt and when he recovered consciousness he was lying in the basement. This testimony of the engineer is corroborated by the other men present.

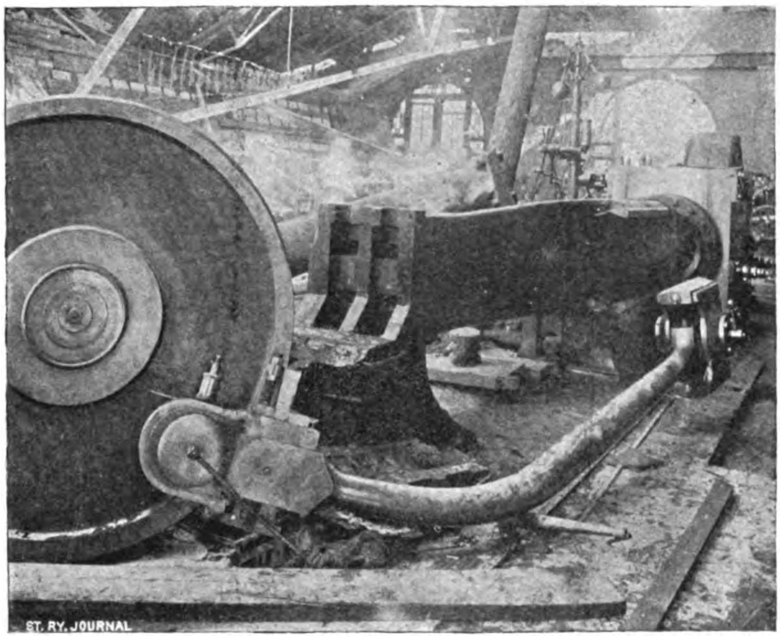


FIG. 2.—ACCIDENT AT THE POWER HOUSE OF THE ATLANTIC AVE. R. R.

The dynamo tender was standing at the time near this engine and was about to throw open the circuit breaker when he saw the engineer motion for him to run, which he did before opening the circuit. The engineer's helper was at the end of the building and when he noticed the trouble started for the scene but wisely stopped before he reached it. The other men in the building at the time were also out of range of the engine and fortunately no lives were lost. The damage to the power house and machinery reaches thousands of dollars.

Work was at once commenced to repair the feeder lines and the machines but slightly damaged and rapidly put in operation.

The California Mid-Winter Fair will receive many exhibitors and concessioners from the World's Columbian Exposition. Many of the concessioners are preparing to go to San Francisco as soon as Jackson Park is closed. The Fair at San Francisco will be visited largely by those who have not visited the World's Fair at Chicago. The great distance has allowed but few from that section of the country to visit Chicago and should the winter be favorable their holiday will be spent at Golden Gate Park. The annual meeting of the National Electric Light Association will bring many of those interested in electric lighting together who have not previously attended the meetings of the association. To a large number of manufacturers this is an entirely new field which will become more and more valuable as the country is developed. No more favorable opportunity will present itself than the one offered the coming winter. Many manufacturers have exhibits of such a kind as are easily moved and many constructed especially for exhibition purposes which could be transferred at little expense to San Francisco, while if they were preparing new exhibits the expense would be many times as great.

The Rudd Ground Alarm.

Among the many devices of practical value shown by the Western Electric Company at the World's Fair was the Rudd ground alarm. This method of measuring the resistance was exhibited in connection with the company's plant, being part of the equipment of the switchboard. By means of this device the insulation resistance to ground of any circuit can be measured while the lamps are burning.

The following diagram of parts and connections fully explains the method employed in measuring the insulation of a live circuit, and is as follows: The circuit is short circuited at the dynamo through a pair of condensers C, which are connected to a drop A which rings a bell when the shutter falls. When the insulation of the circuit falls to a point low enough to charge the condensers, the shutter drops which rings a bell, thus notifying the operator of a grounded circuit. The switches S are then opened and the plugs F inserted. The resistance R consists of various resistances of 100 ohms each. The plug connecting with R is then inserted through the resistance of 100,000 ohms M, which places the Wheatstone bridge in connection with the circuit in exactly the same manner as though the circuits were dead.

When the switch B is closed the current has two courses to travel, one through the plug P, the resistance of the Wheatstone bridge to ground G back through the ground on the arc light circuit to the dynamo, the other through the arc light circuit to the ground, thence to the ground G of the Wheatstone bridge through the resistance to the dynamo. This causes two currents to pass through the galvanometer in opposite directions at the same time. Consequently, when the plug is inserted in resistance R at a point where these currents neutralize each other the gal-

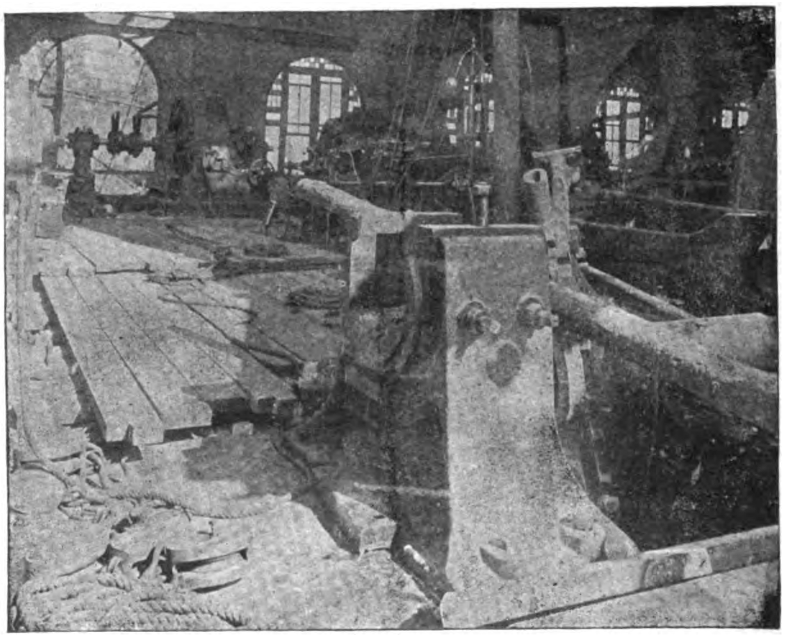


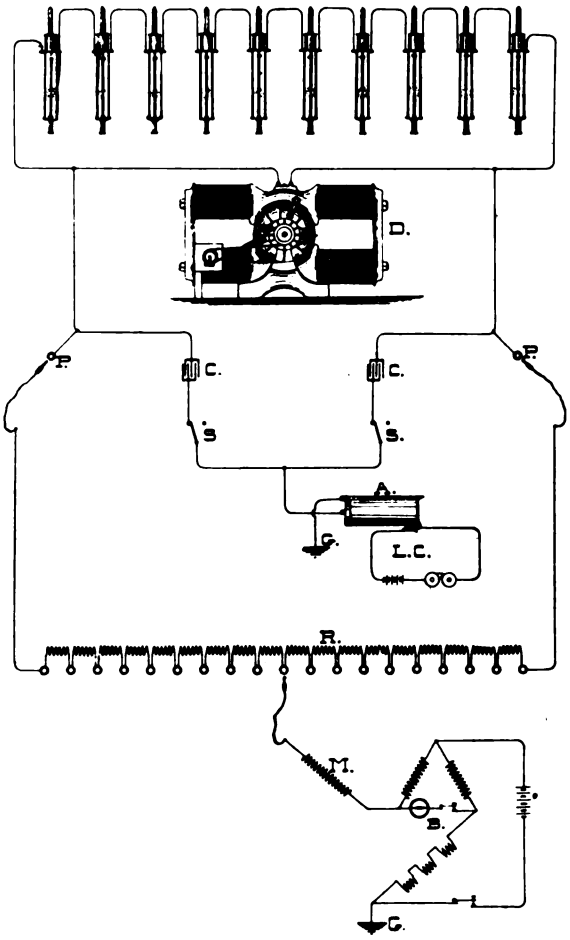
FIG. 3.—ACCIDENT AT THE POWER HOUSE OF THE ATLANTIC AVE. R. R.

vanometer B, will not be affected, and the Wheatstone bridge can then be used as though measuring a dead circuit. After measuring the insulation resistance the fixed resistance of 100,000 ohms plus the resistance R is deducted from the reading and the result is the true insulation resistance of circuit to ground.

The Cummings & Engelman Conduit System at St. Paul.

In the accompanying illustration is given a view of the underground conduit system under construction at St. Paul, Minn. The system is that of Cummings & Engelman, of Detroit, whose system was described and illustrated in detail in the May number of Electrical Industries. This view shows the conduit as it leaves the power house of the Edison company.

The 12 tubes start from the switchboard and run down beneath the power house and leave it as shown in the cut.

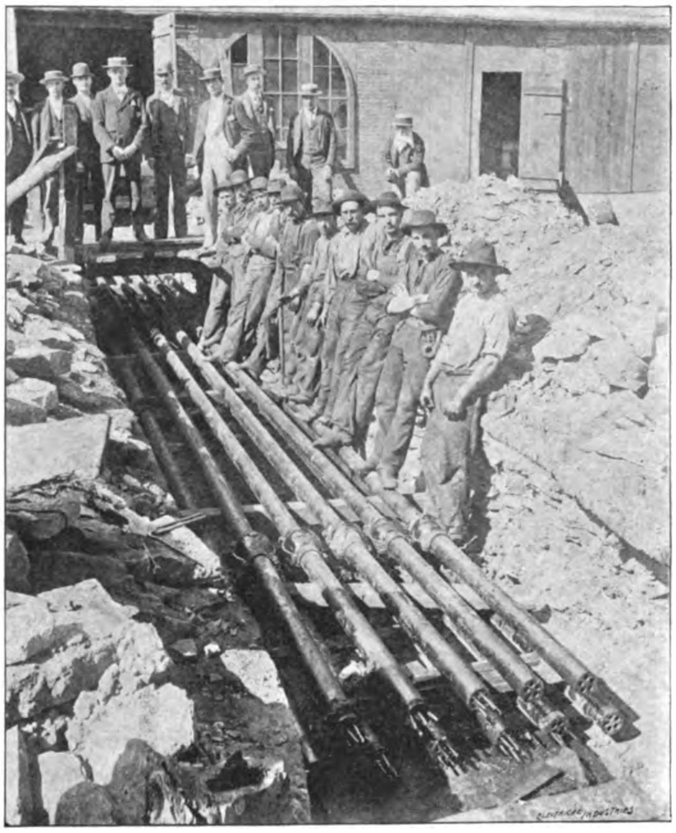


THE RUDD GROUND ALARM.

Each of these tubes contains five ducts and each duct contains a 000 bare copper conductor. These tubes contain all the feeders running from the station and connect with the overhead conductors in a manhole a short distance from the station. It is the intention to place the entire system of distribution underground. The work is to be done gradually so as not to interfere with the operation of the lighting system. The conductors used in this conduit are old lines formerly used in the overhead construction. They are now in constant use and have worked perfectly satisfactorily since they were put in.

This system of underground conduit is of comparatively recent introduction, but the manner in which it is being adopted would indicate that its general use is but a question of time.

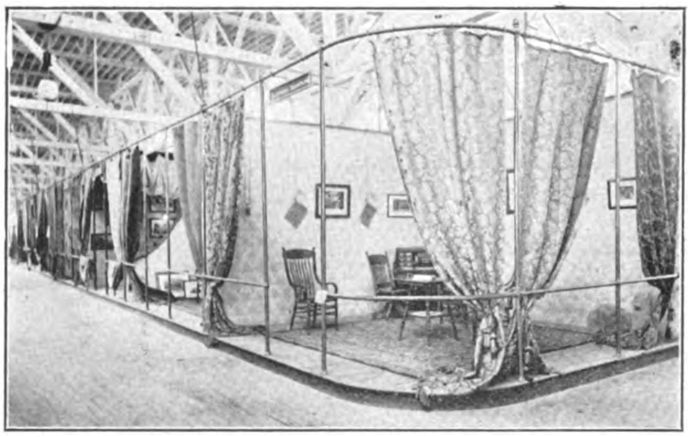
A system of underground conduit is also constructed by this company for high potential circuits, especially adapted for long distance transmission lines. This is an entirely new field, one which the commercial side of electricity is gradually approaching, and which the next few years will undoubtedly see entered by the larger stations and power producers.



THE CUMMINGS & ENGELMAN CONDUIT SYSTEM AT ST. PAUL.

Our World's Fair Headquarters.

The accompanying engraving shows the World's Fair headquarters of Electrical Industries at the head of newspaper row in Electricity Building. It afforded a convenient meeting place for our numerous friends while visiting the Fair. Our register which was always open contains a list of names of people from all over the world and engaged in every branch of the industry.



WORLD'S FAIR HEADQUARTERS OF ELECTRICAL INDUSTRIES.

The names of persons most prominent in the commercial field as well as in the field of science appear on its pages, while the names of representatives from the central stations scattered over the United States include those from nearly every section.

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Correspondence, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

Advertising Rates upon application.

Although the five wire low potential system of electrical distribution has been successfully used in Germany, its adoption in England and America has been slow. The first installation of this kind in England was recently opened at Manchester. This station is a municipal plant, and the success of the system will undoubtedly lead to its further adoption. The central station installed at the World's Fair by Siemens & Halske, in which the five wire system was used, was inspected by many interested visitors.

Intramural transportation at the World's Columbian Exposition was not the great financial success expected. The Intramural Railway carried 5,806,746 passengers. From its receipts it paid the Exposition Company 25 per cent. Its cost exceeded $800,000, so that the company will hardly come out even on the investment. As an advertisement it was a great success, and an elevated road similarly operated is already projected for Chicago. The electric launches have had a very successful run, and are said to have carrried over one million passengers, which should give a handsome profit to the company.

The accident at the power house of the Atlantic Avenue Railroad belongs to a class of accidents that fortunately happen but rarely. To locate the cause of the accident is usually a difficult matter. The unexpectedness and quickness of the accident and the wrecked condition of the machinery renders it almost impossible to secure sufficient reliable information to draw a correct conclusion. From the testimony of the engineers and dynamo tender, the accepted opinion is that the primary cause of this accident was at the generator which received an excessive load; that the engine afterwards raced, that the belt broke, and possibly the generator pulley, before the fly wheel burst.

The Weekly World's Fair Electrical Industries having filled its mission, its publication has been discontinued. When the Exposition opened, it was apparent that there was an important and useful field for a weekly paper devoted exclusively to the electrical and allied interests of the Fair, and Electrical Industries with its usual enterprise, promply undertook to cover this field. By publishing the news and incorporating in it novel features consisting of maps and diagrams showing the location of electrical exhibitors, the paper was made valuable and consequently received a most cordial welcome at the hands of subscribers and advertisers. The paper was read, and the maps used constantly for reference by visitors and the entire electrical fraternity at the Fair, and subscriptions came from all parts of the world. The vast number of original illustrations have cost much labor, time and expense, but we feel that our efforts have been fully rewarded. We thank our friends for their support, and trust they will read the regular issue of this journal with even greater interest and pleasure than before.

The World's Columbian Exposition is now at an end. Its close was marked by no great demonstration, but in sorrow over the death of Chicago's Mayor, the flags were lowered, a salute fired and the Fair was officially at an end. Festival Hall that was to have witnessed a scene of joy over the success of the Fair, witnessed instead, memorial exercises over the death of Mayor Carter H. Harrison. Thus closed the greatest exposition ever held. The whole world united in producing this Exposition, but to Chicago's wonderful enterprise we are indebted for the magnitude and success of the undertaking. When the success is considered in connection with this year of business depression what the success would have been in an ordinary year can only be conjectured. As a civilizing agency the Fair has been far reaching in its influence and effects. Nations but little acquainted with the United States have become familiar with its people, its country and products. Countries in all quarters of the globe have through their exhibits and representatives made the people of the United States and other countries acquainted with their manufactures and products. But to the electrical industry it has been a triumph. Of but recent growth, its displays at former expositions have been small and have attracted but little attention. Electricity was wisely adopted as the means of transmitting power from the central station throughout the grounds. It made it possible to operate in any building in any part of the grounds machinery without disfiguring in any way the light colored interior or exterior of the buildings. It furnished the power for different forms of intramural transportation both on land and on the canals and lagoons. It carried the visitor to the roof of the highest building. It made trips to the galleries of the different buildings easy. It illuminated the grounds and turned night into day. By different combinations and devices, as a means of decoration, places otherwise unattractive were made points of interest and amusement. The power plant and system of distribution together with the displays made by the different manufacturers of electrical goods familiarized the general public with this new industry. Under the able direction of the Department of Electricity, the Electricity Building was made one of the most attractive buildings on the grounds, and in it both day and night there was always a crowd. The displays made by the various companies were certainly a credit to them and the manner in which they placed attendants in charge and the pains with which they explained the exhibits and systems is commendable. Aided by the information and ideas gathered from the machines, plans and literature of foreign and domestic manufacturers which have been thoroughly discussed during the past months the American manufacturers will be able to produce even better machines and the public to purchase and use them more intelligently. After the exhibits are removed and the buildings demolished, there will still remain vivid recollections of the White City, its buildings, grounds, the displays and festive occasions, and the friendships and acquaintances that have arisen from the close relations which have existed during the six months of the city's life.

A serious streeet railway accident is just reported from Portland, Oregon. An electric car on Madison St. ran through an open draw, and plunged into the Willamette river, carrying with it a number of passengers. Owing to the heavy fog, the motor man did not see the red light on the gate until he was almost on it. When he tried to stop the car the brakes refused to work, and the car continued to move until it broke through the gate and plunged into the river. Thus a number of lives are lost on account of the want of caution on the part of the motor man in approaching a dangerous place, or the failure of the brakes to work properly. To the failure of the brakes to work propperly is due a large percentage of the accidents on electric roads, and the worst wreck on the steam roads during the heavy traffic of the past year was due to the same cause.

At a meeting of the exhibitors in the Department of Electricity, held October 30th, to take action upon the presentation of a testimonial of some kind to Chief Barrett and Assistant Chief Hornsby in token of the appreciation felt for the courtesy with which the exhibitors had been treated, a committee consisting of Mr. Thomas R. Lombard, Dr. H. A. Lawton and Mr. Geo. B. Clark was appointed to draw up a preamble and resolutions tendering thanks to Chief John P. Barrett and Assistant Chief J. Allen Hornsby for their unfailing courtesy to the exhibitors at all times, and it was ordered that a copy of the resolution be engrossed and presented to each of the gentlemen by the committee on behalf of the exhibitors. The committee was also instructed to procure a suitable souvenir to be presented to General Superintendent John W. Blaisdell.

The 12th annual meeting of the American Street Railway Association, which was held at Milwaukee Oct. 18-19, was well attended. The preparations for the convention had been carefully made, and to the Milwaukee Street Railway Company and the citizens of Milwaukee the association is indebted for its pleasant reception and many marks of attention during its stay in the Cream city. The papers read were fully up to the standard, and several called forth lively and interesting discussions. This is specially true of the paper read by Mr. E. G. Connette on Power House Engines. The great attractions of the World's Fair greatly lessened the attendance toward the close, many leaving for Chicago before the convention ended. Owing to the enormous passenger traffic of the railroads, the railroad yards and side tracks are full of freight waiting to be moved, and on this account a great many manufacturers of railway apparatus were unable to exhibit their goods as they had intended. Many although greatly disappointed at not receiving their goods made the most of the situation and established headquarters in the exposition building at their hotel where they could meet their friends. The tendency toward consolidation is noticeable in the report of the executive committee, which shows that 10 roads formerly members of the association have been absorbed by other companies. The consolidation of the roads of a city has its advantages to the roads themselves and to the public in general, still it often has objectionable features. The convention closed Friday. The next meeting is to be held at Atlanta, Ga.

The banquet at Milwaukee Thursday evening at the Pfister Hotel was attended by 256 ladies and gentlemen. At the table of honor sat the newly elected president, Mr. H. C. Payne and the new executive committee of the association. At Mr. Payne's right sat Mrs. Payne while on his left sat the Rev. Judson Titsworth. The banquet hall was on the seventh floor of the hotel. The floral decorations were elaborate and of handsome and appropriate designs. The banquet was well planned and all voted it a great success.

Ex-president Longstreet acted as toastmaster and to the first toast, "Transportation and Civilization" Mr. J. C. Flanders responded. In his remarks he called attention to the facilities for rapid transit and said that the annual savi -ng to the four billion passengers carried annually, by the introduction of electricity was a million hours, which if calculated in dollars and cents would show a large amount of money which the public owes to street railway managers. "Street Railway Employes and the Public," responded to by Mr. Ogden H. Fethers was heartily appreciated and received great applause. Mr. Winfield Smith responded to "The Early Days of Street Railways" and Mr. H. H. Windsor to "The Street Railway Man of the Past, Present and Future." Mr. Horace Rublee upheld "The Press" and Mr. J. Harvey Stedman read an original poem.

One of the mementoes of the banquet was a souvenir spoon for each guest of sterling silver. In the bowl of the spoon was a representation of President Paynes' private car, to whom the delegates were indebted for this further evidence of Milwaukee's hospitality.

The Cataract Construction Company.

The awarding of the contract for the generators for the power plant of the Cataract Construction Company, at Niagara Falls, has just been announced. The apparatus is to be built in units of 5,000-horse power. The revolving field of the generator will be constructed with inwardly projecting poles and will revolve in a horizontal plane being mounted upon the vertical shaft of the turbine. The electro-motive-force generated will be 2,000 to 2,400 volts and any further increase in voltage required by a long distance transmission will be made by step up transformers. For use in the vicinity it will be lowered by reducing transformers as the case demands. The system adopted is the two phase alternating current Tesla system, which was selected by the engineers of the company after a careful study of the conditions under which this apparatus had to operate. Some time ago negotiations were conducted with the larger manufacturers of electrical apparatus and bids were received from them based upon specifications for systems advocated by the individual companies, the company being at liberty to offer a bid on whatever system it might advocate for the service, but the specifications for the bids upon which this contract was awarded were prepared by the engineers of the Cataract company. The contract was awarded the Westinghouse Electric & Manufacturing Company. The motors will be the two phase Tesla motor which have shown their efficiency as power motors. From the amount of power generated at this plant a large part of it will necessarily be transmitted to some distance. For increasing and diminishing the tension of the current this system readily adapts itself. It is understood that the company contemplates sending current of high potential to Buffalo for power and lighting purposes. Dr. Coleman Sellers is the engineer of the company and Prof. Geo. Forbes of London and New York is consulting engineer. The awarding of this contract was watched with great interest and the competition was very sharp between the larger electrical companies. It should be gratifying to the Westinghouse company to receive the contract and know that the system it specially advocates was adopted. The work upon the apparatus has already begun and it will be installed as soon as it is possible to complete it.

The St. Pancras Electric Lighting Station.

An electric lighting station which is decidedly modern in design and equipment, and which contains many features which are worthy of notice is that which has been established by the St. Pancras Vestry at Regent's Park, London. It supplies what is known as the southwest district, and is able to furnish 10,000 incandescent lamps of 16-candle power and 90 arc lamps of 10 amperes each.

The building of the station contains an engine room 160 feet long by 26 feet wide, a boiler room 53 feet long by 35 feet wide, and offices and storerooms of sufficient size to accommodate the needs of the company. The chimney is five feet square inside and rises 90 feet high. Special attention was given to the foundations for the machinery and building. The foundation for the engines and generators is composed of a bed of concrete 86 feet long, 12 feet 3 inches wide and 8 feet deep.

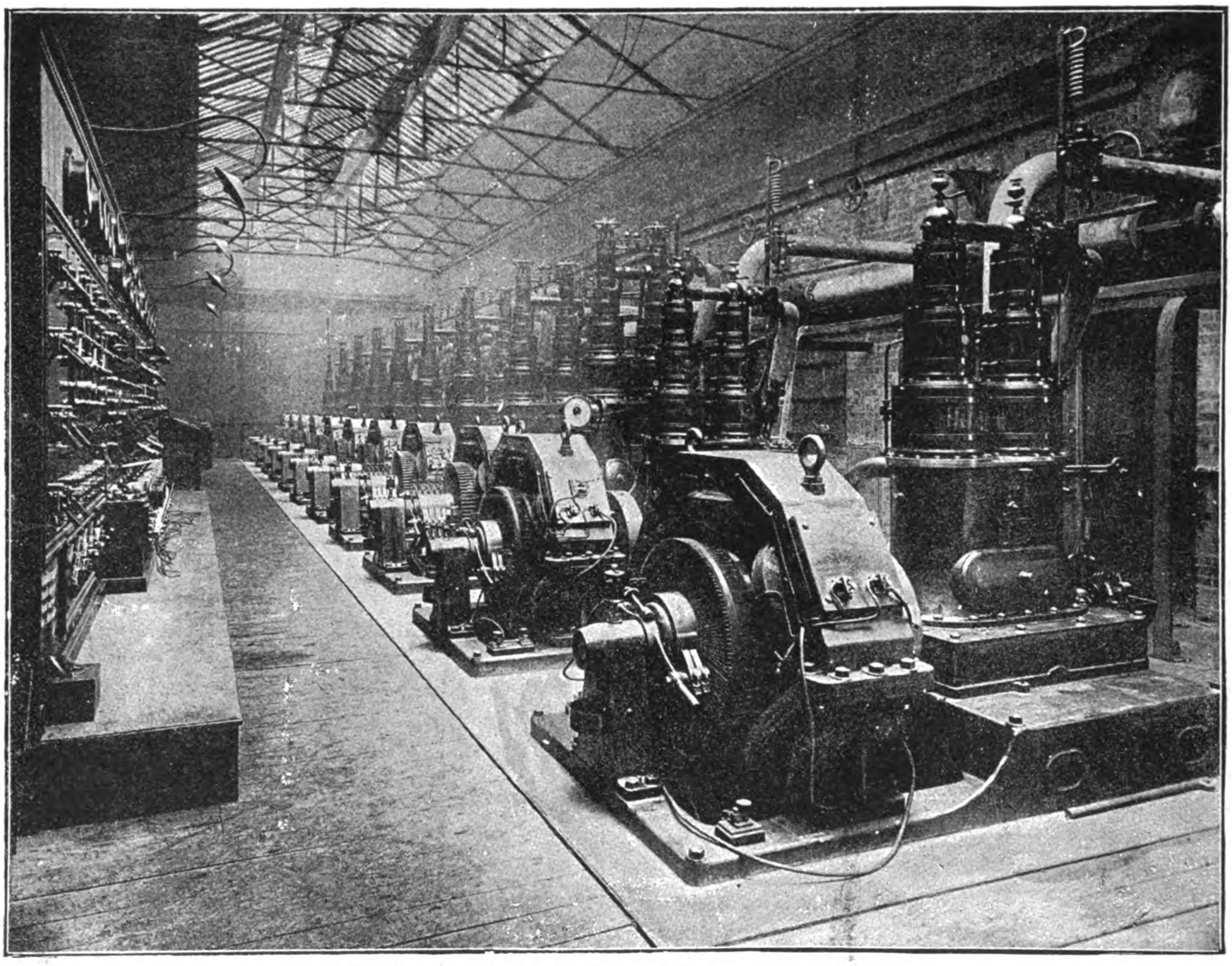


FIG. 1.—THE ST. PANCRAS ELECTRIC LIGHTING STATION.

The foundations of the building are entirely separate, and the floor is supported independent of the foundation for the machines. Between the foundations of the building and the foundation for the machines there is ample space for steam pipes, condensers, electrical connections, etc., thus the engine room is unobstructed by steam pipes and connections, except the main line of steam pipes at the rear of the engines.

The boilers of which there are five are the well-known Babcock & Wilcox pattern, and were installed under a guarantee that one pound of the best Welch coal should evaporate 10 pounds of water at 212 degrees. Under tests made by Prof. Robinson 11.9 pounds of water were evaporated per pound of coal. The engine room has been most economically arranged. In selecting the engines they have selected those which would allow a compact arrangement. The switchboard has been placed in a convenient position and is easily reached and in constant view of all parts of the engine room.

The dynamos are of the Kapp type, of which nine are wound for 680 amperes, and two of 90 amperes at 540 volts. The latter are used for street arc lighting and for charging storage batteries at the central station The engines are of the triple expansion, vertical type, and were supplied by Messrs. Willans & Robinson, Ltd. The engines and dynamos, which are of multipolar type, are directly connected and consequently making a very compact combination. At repeated tests they have developed from 18.65 to 19.6 pounds an electrical horse power, with a load of 680 amperes at 118 volts.

This type of engine is somewhat new to this country, but they are now being manufactured by M. C. Bullock & Company of Chicago, who have an established reputation as engine builders. Their general adoption is only a question of the time in which the special merits of this class of engine for driving electrical machinery becomes fully understood by engineers and the public in general. The Willans central valve engine is a single acting engine. Its brasses are constantly in compression, to enable it to run at high speed without knocking. The valves, which are of the piston type, work inside the piston rod and give an excellent distribution of steam and an unequaled drainage for water. In active service these engines have shown great economy in operation, and are especially adapted for the high speeds that the economical operation of electrical machines demand.

Each line of pistons is connected to its corresponding crank by two exactly similar connecting rods with a space between, in which works an eccentric forged solid upon the crank pin. The connecting rods work at the top upon two hardened steel pins. Piston valves are used moving inside the hollow piston rod which passes completely through the line of pistons and through the ends of the cylinders.

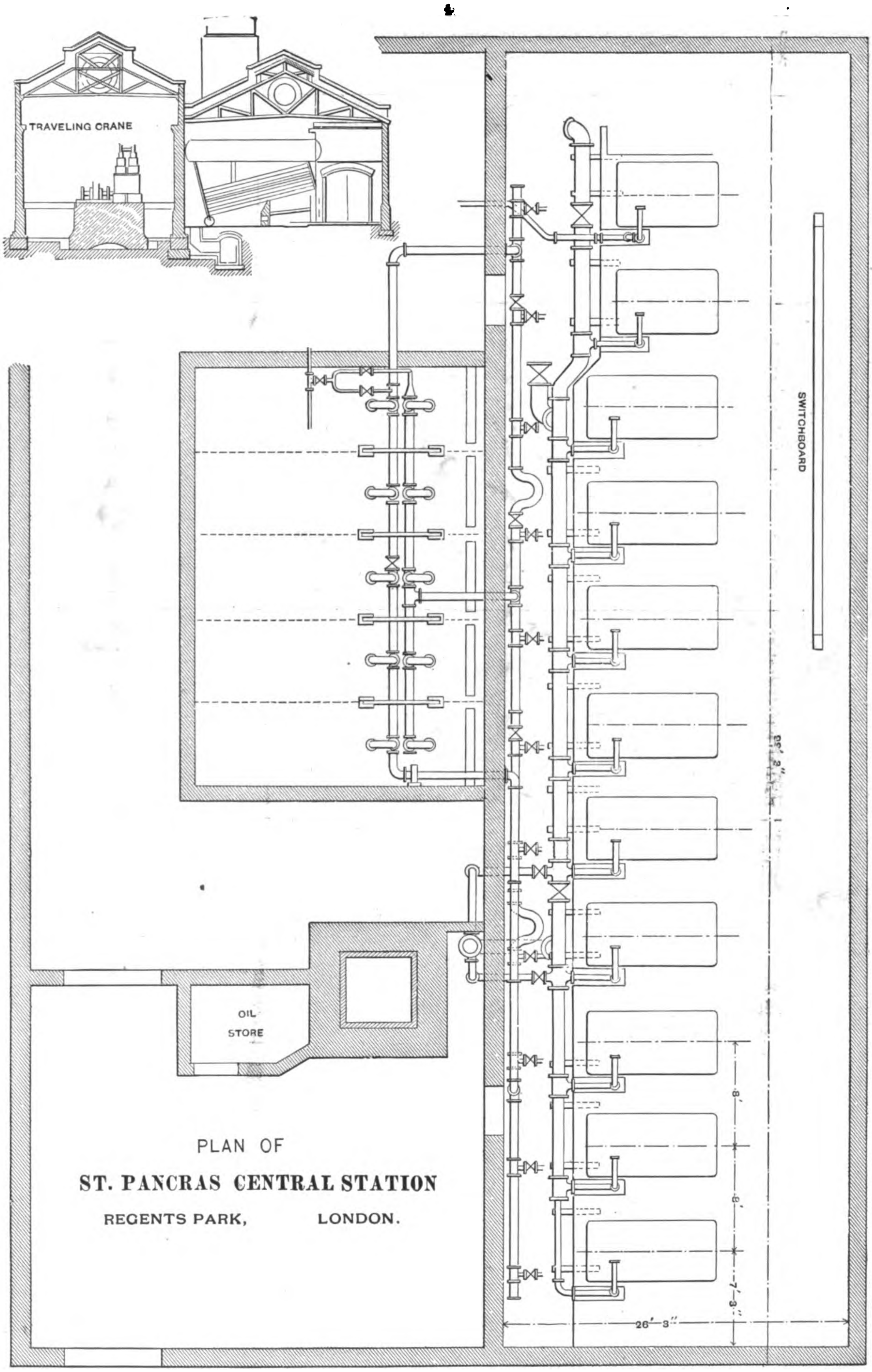

TRAVELING CRANE
SWITCHBOARD
OIL STORE
PLAN OF
ST. PANCRAS CENTRAL STATION
REGENTS PARK, LONDON.
26' 3"
8'
8'
7'-3"
26'-3"

FIG. 2.—THE ST. PANCRAS ELECTRIC LIGHTING STATION.

An Electric Elevated Road for Chicago.

On October 30th articles of incorporation of the Northwestern Railroad Co., were filed with the secretary of state at Springfield, Ill. Although the route for the road has not been definitely fixed it will run from Congress street at a point east of the south branch of the river north until it crosses the main branch of the river, from where it will take a northwesterly direction to the limits of Cook county. A branch is also contemplated running from the main line at a point between North avenue and the Chicago river in a westerly direction. The motive power is to be furnished by electric motors, the electricity being conveyed to the motors through a third rail similar to that on the Intramural Railway at Jackson Park. The road is said to have sufficient financial backing for its completion, and that the right of way, franchises, etc., will at once be secured.

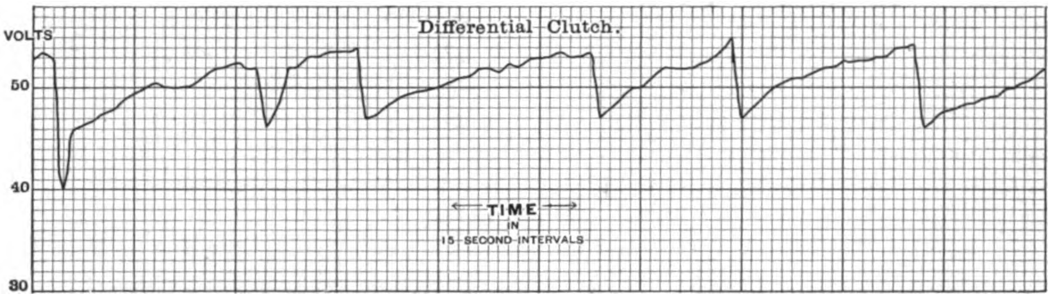


FIG. 1.—POTENTIAL READINGS OF ARC LAMPS.

Potential Readings of Arc Lamps.

BY CARL K. MAC FADDEN.

There is probably no easier way of obtaining data in regard to arc lamp feeding mechanism than by means of a direct reading dead beat voltmeter, a block of cross section paper and a watch. The usual form of arc lamp for series work, either the clutch or geared type, will be found to have a variation in voltage at the carbon points which, when plotted on cross section paper, will be a startling revelation as to the irregularity of carbon feed, even in a lamp which is apparently giving a practically steady light. By means of the voltmeter it is at once seen that the eye does not notice a gradual change in candle power, but notices only a marked and sudden change as when the carbons are feeding or when the lamp is "flaming."

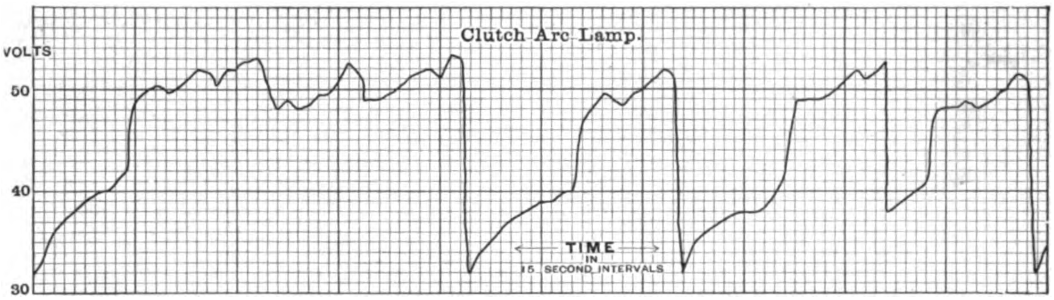


FIG. 2.—POTENTIAL READINGS OF ARC LAMPS.

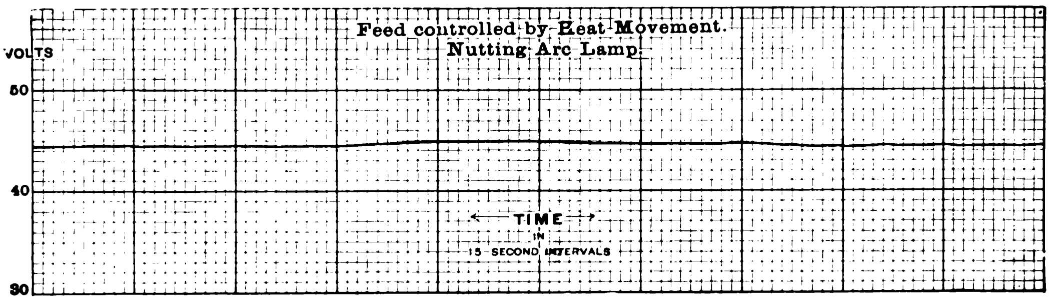


FIG. 3.—POTENTIAL READINGS OF ARC LAMPS.

For the purpose of obtaining data on various feeding mechanisms now in use in feeding series arc lamps, the writer has made a large number of potential readings of various types of arc lamps. A clutch lamp for instance, will be taken and adjusted so as to get the least possible variation in voltage at the carbon points when the lamp is in operation with a good grade of carbon. A reading will be made, or several of them, and the lamp will then be placed in an exposed position for two weeks on a commercial lighting circuit, trimmed and used each day, and then brought in and tested, or a potential reading taken from the lamp as it hangs in actual service. The results obtained are then compared, and the change of adjustment is usually quite apparent. The three figures shown will clearly illustrate results obtained from tests made in the described manner. Fig. 1 shows the reading of a well known make of clutch lamp which was adjusted in the best possible manner. The readings were taken at 15 second intervals, thus making the reading shown extend over a period of 25 minutes. The actual readings extended through a period of from 1½ to 3 hours, owing to the fact that the magnet-fed lamps do not usually reach their actual running voltage for some time after they are started, owing to the variation of the resistance of the shunt windings, due to their heating. This variation has different effects in the various makes of lamps, but is invariably enough to make a very perceptible difference in the point at which the lamp mechanism releases the carbon rod and allows it to feed.

A noteworthy point to be examined in Fig. 1, is the voltage at which the rod is released, 50 to 53 volts, and also the voltage at the carbon points after the rod has again been gripped by the clutch. This uniformity of action is especially interesting. The drop to 40 volts at the beginning of the reading was quite likely caused by a flaw in the carbon, as it occurred several times in a test extending over about three hours. I may safely state that there are few clutch lamps, which, when adjusted at their best, will keep as uniform a voltage at the carbon points as the one shown. Fig. 2 is a reading taken from the same lamp whose test is shown in Fig. 1. After reading Fig. 1 had been taken, the lamp was placed for two weeks in an exceptionally dirty and smoky position, at the end of which time reading Fig. 2 was taken.

A number of tests made of lamps in the same locality showed them all to be in about the same condition. It should not be understood that the lamp from which reading Fig. 2 was made was not in serviceable condition, for it is practically the condition in which many lamps on commercial circuits will be found. In Fig. 2 a marked rise in voltage is noticed each time the reading approaches the 42 volt mark. This voltage invariably rises immediately to about 48 volts. The 42 volt point defines the length of arc at which the carbons stop "hissing" and become quiet, and is always marked by a very decided rise in voltage. It is, of course, evident that a lamp in the condition of that shown by reading Fig. 2 is not giving a uniform candle power, the watts used in the arc varying from 320 to 530. The irregularity of the feed and the manner in which the clutch handles the carbon rod, denotes either a dirty clutch or rod, or both. The carbons used in the three tests were of the same quality and make.

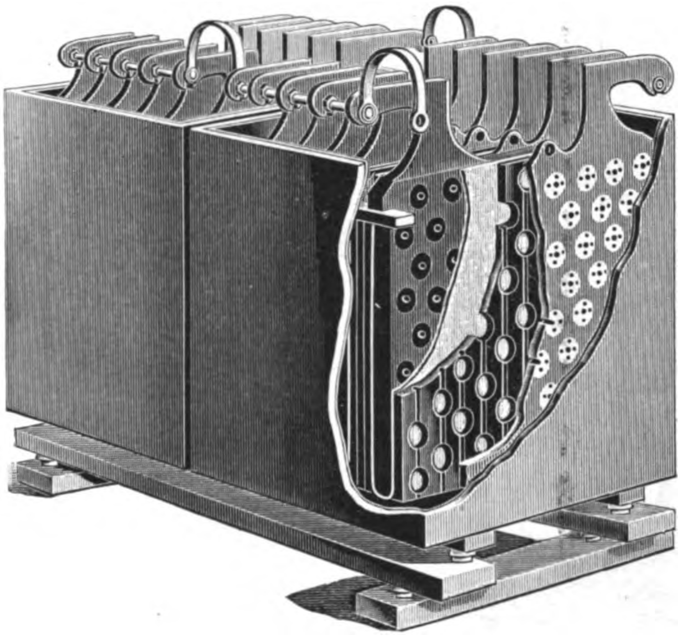


FIG. 1.—THE CHLORIDE ACCUMULATOR.

Fig. 3 is a reading taken from a lamp whose feeding mechanism is controlled by the heat effect of a shunt circuit around the arc as used in the heat movement of the Nutting arc lamp, this lamp being the only lamp on the market controlled in this way. The lamp from which reading Fig. 3 was taken had been adjusted to maintain a voltage of 45 volts at the carbon points, and reading Fig. 3 was taken after the lamp had been in service four weeks under the same conditions that the clutch lamp had been working from which reading Fig. 2 was taken. The readings of the Nutting lamp at the beginning of the test was the same as the reading after four weeks' hard service. Both readings 2 and 3 were taken from lamps in actual lighting service.

It will be noticed that the variation in voltage is not over ½ volt, which, of course, shows that the carbons are being fed forward at the exact rate at which they burn away. The light therefore must be perfectly steady, and the reading shown is as near an ideal reading as could be desired. The cause of the perfectly uniform feed and extremely small variations of voltage is probably due to the fact that since the lamp depends on the "heating effect" of a current for its feed, that it is extremely sensitive to small variations in the arc. The heating effect of a current passing through a given resistance, varies with the square of the current. Thus in a feeding mechanism of this type the feeding forward of the carbons or the alteration of the rate of feed varies with the square of the potential variation at the arc. From many readings taken from this type of lamp it is easily seen that an adjustment once made is a permanent thing, and is not likely to be affected by dirt or smoke.

The voltmeter also offers an extremely simple method of noting the relative action of automatic cut-outs used in the various makes of arc lamps, and considerable interesting data may be collected in a short time by plotting down the rise in voltage necessary to cut out some of the best known types of arc lamps. The station manager of an arc plant may do well to make a few such readings as have been reproduced in this article as it leads often to a more clear understanding of the "modus operandi" of the much used and little studied arc lamp.

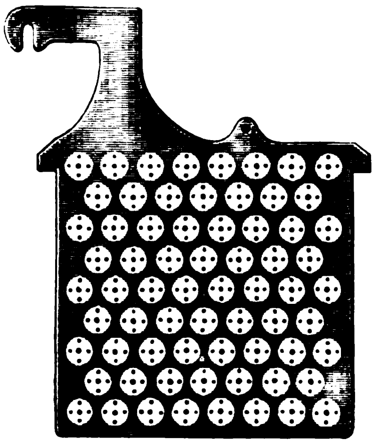


FIG. 2.—THE CHLORIDE ACCUMULATOR.

The Chloride Accumulator.

Although quite extensively used in Europe the secondary battery known as the chloride accumulator which is of modified form of the Laurent-Cely storage cell has been but little used in the United States. Preparations for its manufacture in this country have been made by the Electrical Storage Battery Company, of Philadelphia, at Clouchester, until a new factory being erected at Germantown Junction is completed.

In the Provident Life & Trust Company Building, in Philadelphia, there has been installed a large plant having a capacity of 1894 ampere hours which at a recent trial exceeded the company's guarantee by 50 per cent. The battery is said to be especially adapted for railway work and on the Metropolitan Railway in Washington, where they have been in use several months have given excellent satisfaction. A description of the method of constructing the plates and cells will show the special adaptability of the cell for central station and railway work.

In its manufacture chloride of lead is produced by dissolving finely granulated lead in nitric acid, forming a nitrate of lead. This is precipitated by hydrochloric acid as an insoluble chloride, the nitric acid being recovered and used over again. The chloride, in the form of a fine powder, is then mixed with a certain amount of chloride of zinc, which is a by-product of the later stage in the process, and is then fused in a crucible. The fused mass is cast into buttons or pellets about an inch in diameter and of a hard, glassy texture. These buttons, of such form as to key into the plate, are arranged in a mould, and, under heavy air pressure, a plate, consisting of an alloy of lead and antimony is cast about them. The result is a solid plate studded with numerous buttons of the mixed chlorides.

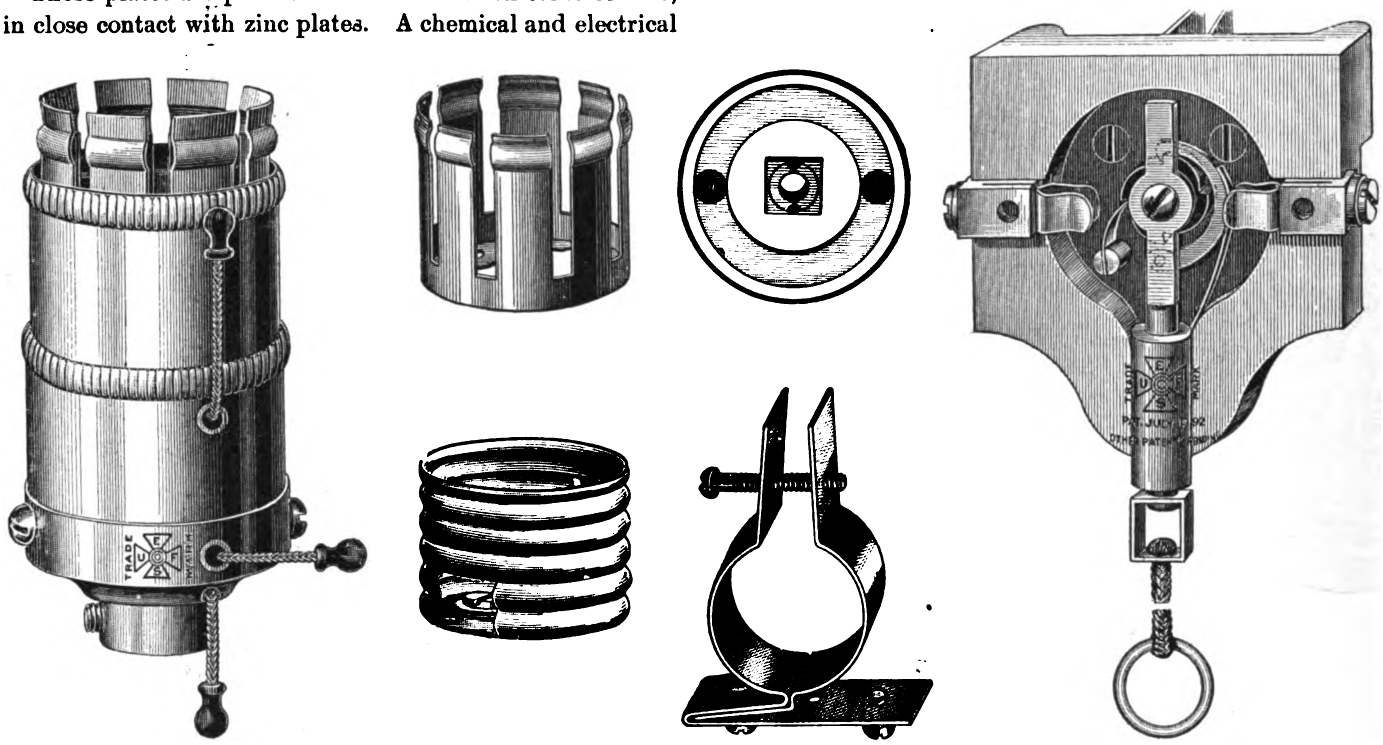
These plates are placed in a solution of chloride of zinc, in close contact with zinc plates. A chemical and electrical action takes place, the chloride of zinc is dissolved out, the chlorine of the chloride of lead leaves the lead to attack the zinc plates, which it speedily eats into dèbris, and the plate is left a mere grid of antimony and lead, in which are a number of buttons of pure, soft, spongy lead. As the spongy lead is produced by chemical means from a crystalline mass the lead itself is left as minute crystals, arranged perpendicularly to the surface, and, consequently, it is perfectly porous, and exposes the largest possible amount of surface to the action of the electric current. The positive plates, after washing and fusing into series, are ready for use, but the spongy lead in the negative plate must be converted into the condition of per-oxide, which is done by exposing it for two or four weeks to the action of a continuous electrical current in a bath of sulphuric acid. At the end of that period the buttons are converted into the peroxide of lead and it only remains to connect the grids into series by fusing the lugs on each plate. Each positive plate is then enclosed in a layer of abestos cloth, and is insulated from the negative plate by a wooden shield covered with asphaltum. The positive and negative plates are plunged in a cell containing dilute sulphuric acid and are ready for use.

The large surface exposed to the action of the fluid on account of the porosity of the plates, the perfect crystalline condition of the active material, its good mechanical construction and its durability are some of the features claimed for this cell.

Stirn's Electric Pull Socket and Switch.

A new device for turning on and off the electric light is manufactured by the Universal Electric Pull Socket & Switch Company, 315 E. Ninety-fourth St., New York. The socket is adapted for use with either the Edison, Thomson-Houston or Sawyer-Man lamps and makes and breaks the circuit by merely pulling the cord or chain in whatever position the lamp may be.

The great convenience of this socket when used in connection with electroliers or bracket lights, not easily reached, is at once apparent. Lights are more easily installed after a building is completed as special lines are not required to be run for the switch. In adapting the lamp to the socket for the different styles of lamps the special fittings shown in the accompanying cuts are necessary. For the Thomson-Houston lamp no adjustment is required. For the Edison lamp the screw neck must be inserted into the socket where it is easily secured by turning the notches in the bottom flange of the screw neck over the heads of the screws already in place. By tightening these screws it is held firmly in place.



STIRN'S ELECTRIC PULL SOCKET AND SWITCH.

For the Sawyer-Man style of lamp the longitudinally cut spring neck is used. It is inserted and fastened in the same manner as the above. After it is secured the Sawyer-Man lamp may be inserted where it is firmly held by the several prongs of the split spring neck. The pin on the foot passes into the split hollow screw in the universal socket. In whatever position the socket is placed the cord or chain passes over the groove friction pulley and through an aperture in the socket. When it is desired to turn on or off the light it is only necessary to pull down on the cord which afterwards automatically returns to its previous position.

Stirn's electric pull switch is also manufactured by the same company. It is especially adapted for many places and among its many advantages the ease with which the current is turned on or off is worthy of mention. A slight pull on the cord operates it. It is easily adjusted to any electrolier or may be used as a wall switch. Its construction is shown in the accompanying cut. It is simple and durable in construction and the brush contacts wear bright with use thus making always a good connection.

New Packard and Mogul Lamps.

The new style Packard incandescent lamp although being manufactured by a new method of construction still retains the qualities of long life and maximum efficiency which the old Packard lamp possessed in such a valuable manner. The new style lamp also shows several genuine improvements which add much to the commercial character of the lamp. These lamps are manufactured under the N. & C. patents under which twenty licenses have already been granted and a number of others applied for.

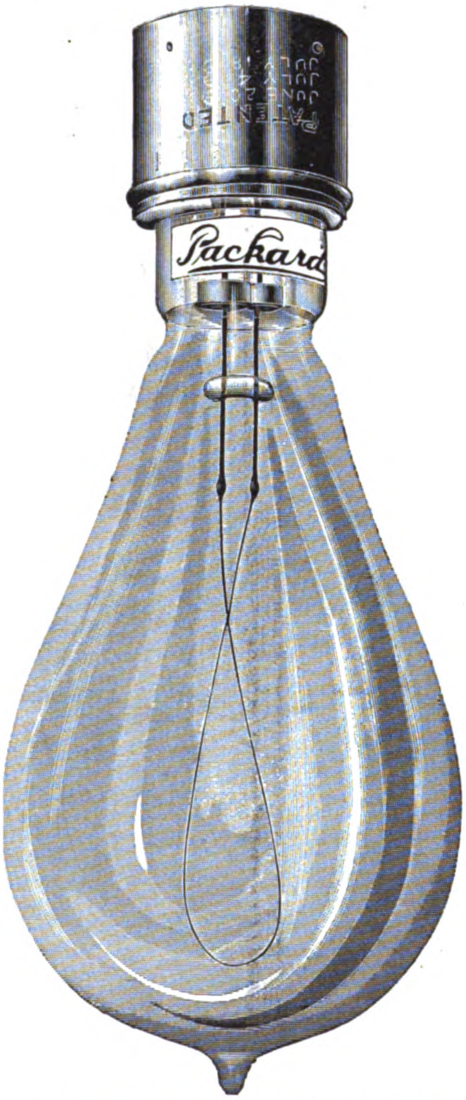


FIG 1—NEW PACKARD AND MOGUL LAMP.

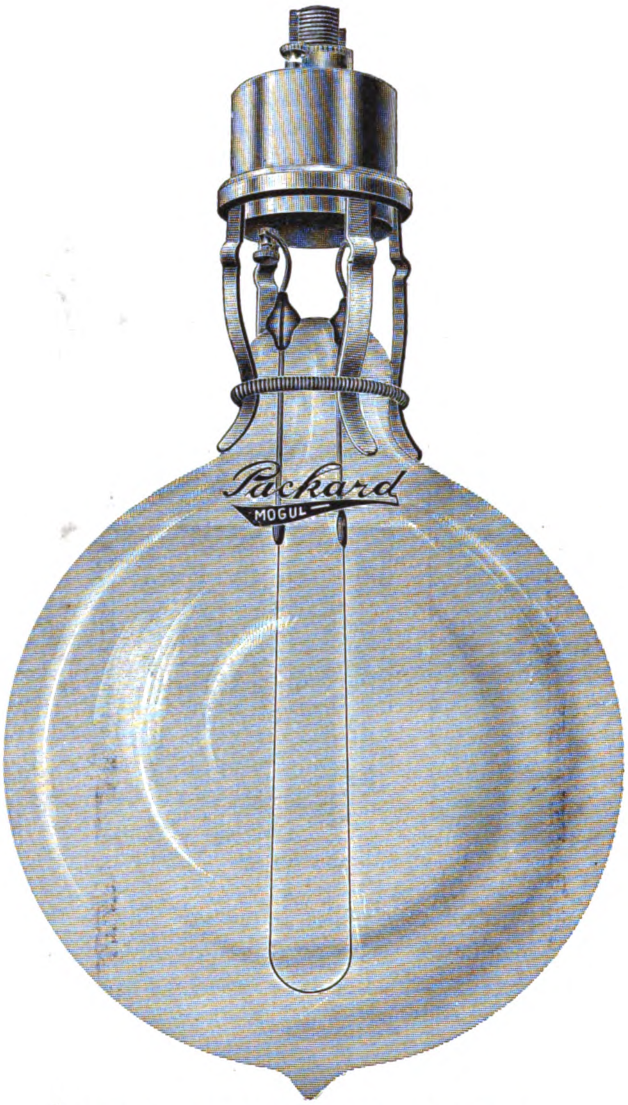


FIG. 2.—NEW PACKARD AND MOGUL LAMP.

Under this method the neck of the lamp is closed by cement, and iron leading-in wires are used, which are not sealed into glass. The Mogul lamps are at present made in sizes of 200, 300 and 500-candle power and other sizes up to 1000-candle power are being prepared. The general style of this lamp is shown in Fig. 2. A special porcelain socket and shade is used with the lamp which are permanently attached to the fixture or suspending cord and do not have to be renewed with the lamp. Packard Moguls are especially adapted for lighting stores, large halls, reception rooms, and in short wherever a good steady and efficient light is required.

They are made in two classes; A, high efficiency and B, longer duration. They can be made for any efficiency. When they are run at the usual efficiency of the ordinary incandescent lamp the life exceeds that of the latter but for lighting large spaces it is found more economical to run them at the highest standard. Superior carbons, large in diameter of very low resistance and run at high incandescence make the lamp of very high efficiency. By the use of a gas in their manufacture it is possible to maintain an almost constant candle power during the life of the lamp. An efficiency of two and one-half watts per candle power is obtained and consequently with the same dynamo an engine power nearly double the light can be obtained from this lamp.

As compared with small incandescent lamps and arc lights in opal globes they give nearly two-thirds the light for the same expenditure of watts. The light is absolutely steady and never falls in brightness or wavers as does the arc lamp. The color of the light is pleasant and casts no objectionable shadows. It gives no hissing noise and requires no attention from the first installment until the lamp gives out. These lamps are manufactured by the New York & Ohio Company at its factory at Warren, O.

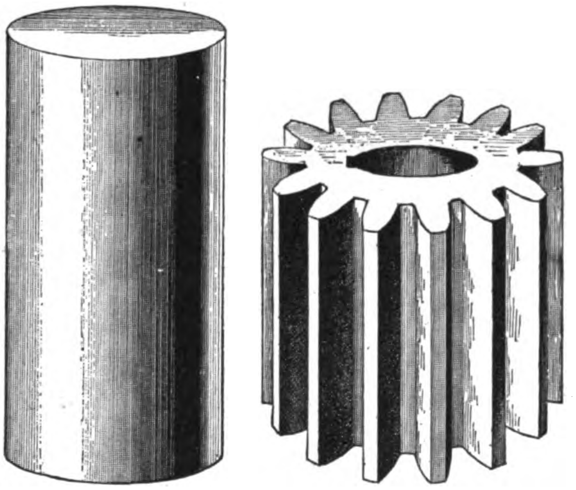
The exhibit of the Western Electric Co. was one of the most interesting at the Fair.

Pressed Steel Pinions.

In the accompanying cuts are shown in Fig. 1 a steel cylinder, in Fig. 2 a pressed pinion, which is manufactured from the steel cylinder while hot. This method of manufaturing pinions is now pursued by the United States Projectile Co., of First Ave. and 53d St., Brooklyn, N. Y. Formerly the method of manufacturing pinions has been either that of cutting from the solid block or else using a casting with the teeth recut. In the first method soft steel is sometimes used to facilitate their manufacture and reduce the wear of the tools used in cutting the teeth.

In the latter process the castings are often liable to be brittle or imperfect, thus greatly reducing their durability. This company, on account of the character of its products, which include solid drawn steel projectiles furnished in large quantities to the government has one of the largest hydraulic plants in this country, which give it facilities unsurpassed for manufacturing pinions by this method. Pinions of this kind are said to have been run on Brooklyn city railway for over a year and have proved very efficient in service.

The process of manufacture is very interesting. In manufacturing a pinion the workman takes a round billet of such a size as the pinion requires. This is heated to a white heat and is then placed in a die and subjected to an enormous pressure. It is then forced out of the die, is faced off on the ends, bored and key-seated in the usual way when it is ready for use. The teeth require no cutting as they are accurate in size. In pinions manufactured by this process the pressure compresses, solidifies, and toughens the metal far more than it can be done by any other process, thereby prolonging the life and durability of the article. On account of being forced into every tooth the metal possesses a continuous grain.



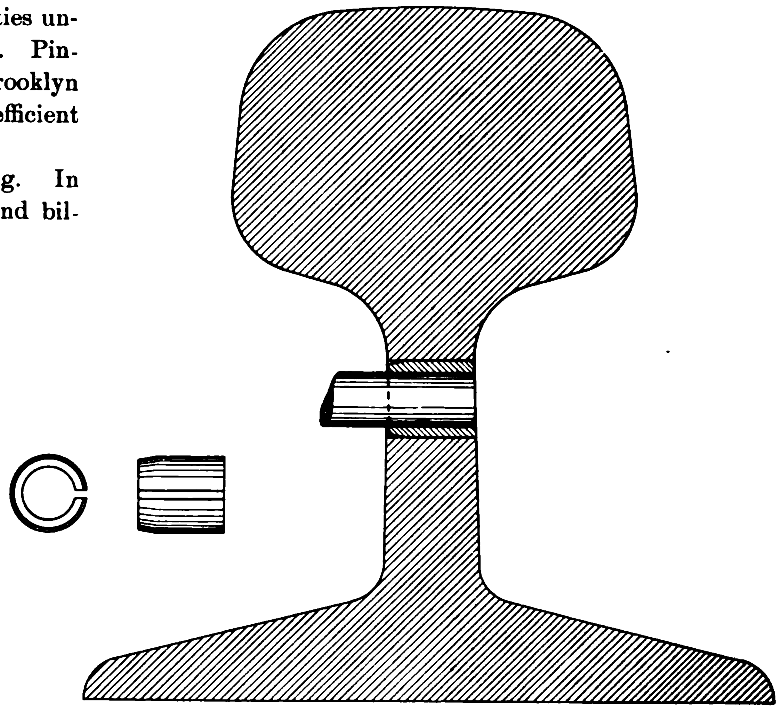
FIGS. 1 AND 2.—PRESSED STEEL PINIONS.

The company has spent considerable time in experimenting and has but recently placed them on the market. The pinions, on account of their wearing qualities and low cost of production, will undoubtedly be generally adopted.

A new application of the incandescent lamp has been made by Mr. G. W. Patterson. Mr. Patterson, being an expert Indian club swinger, has frequently given exhibitions before parties of friends and acquaintances, but the idea recently occurred to him of adding something to this form of entertainment. On consulting with Mr. McLean, of McLean & Smith, who are well known manufacturers of electrical specialties, he learned that his ideas were practical, and they immediately set to work to perfect the plans. An ordinary pair of Indian clubs were covered with electric lights of red, white and blue globes. By running the wires through the end of the clubs, the lamps were easily connected with an electric lighting circuit. At a recent test made before a party of invited guests, Mr. Patterson gave a remarkably satisfactory exhibition. The circles of light of different colors circling round and round in the most complicated paths, was a very interesting sight. A few changes are to be made in the connections when the clubs can be used as easily as the ordinary clubs.

Rail Bond Spring Bushing.

The best method of connecting the return circuit on electric roads is attracting a great deal of attention at this time. In the early days of electric roads, this matter was not given the attention it deserved. While it has been recognized that a perfect return circuit was needed, yet the means of making provision for such return have been very imperfect and unsatisfactory. The old style rail bonds did not make a perfect joint; the one piece rail bond was found expensive; the channel pin was hard to drive and the result was unsatisfactory, as it often came out in a short time.



RAIL BOND SPRING BUSHING.

The Railway Equipment Company, Chicago, on account of its supplying a large and important electric railway trade has naturally studied this important matter. Realizing the necessity of providing an economical and practical connection, one which would provide an absolutely perfect connection, doing away with the possibility of corrosion, oxidation or electrolysis, in fact making such a solid joint that no air or moisture could possibly enter to destroy the connection, it has lately brought out a new rail bond spring bushing which bids fair to become standard in the trade. This bond is shown in the accompanying illustration. The bushing is a steel tube and measures one thirty-second inch larger than the hole in the rail; an opening in the bushing measures just one thirty-second. When the bushing is put on the wire and driven in, the opening closes tightly and results in making practically one piece of the rail, bushing and wire. As a needed addition to the equipment of electric roads, this device is worthy of investigation.

The Kennelly Standard Electrostatic Voltmeter.

In the accompanying illustration are shown two views of the Kennelly standard electrostatic voltmeter which is manufactured by the Edison Manufacturing Company of 110 E. Twenty-third St., New York City. It is designed for central station work and can be used on either continuous or alternating circuits. It is made in two sizes indicating up to 600 and 1150 volts respectively. It is attached in an upright position to the wall or switchboard.

A horizontal aluminum vane is suspended bifilarly and carries vertical sectors of the same metal which travel freely in curved brass grooves. The vane and sectors are electrically connected through the suspension wires with one side of the circuit and the brass grooves with the other so that the E. M. F. sets up an electrostatic attraction between these parts and the sectors enter the grooves twisting the suspension wires until arrested by a gravitational force.

The vane and sectors carry a horizontal pointer of six inches radius over the curved face of a scale eight inches long, and the index points to the E. M. F. supplied to the instrument terminals. On the scale of the 600-volt instrument intended for use on 500-volt circuits, a variation of five volts, or one per cent at load, makes a change of about one-eighth of an inch.

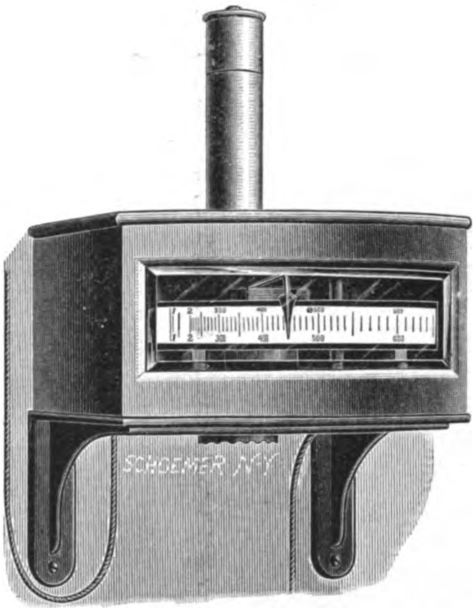


FIG. 1.—THE KENNELLY STANDARD ELECTROSTATIC VOLTMETER.

As the vane and grooves are connected directly across the bus bars, any accidental metallic contact between them would produce a short circuit. To prevent this the walls of the grooves are heavily japanned so that contact with the vane allows no spark to pass. As an additional security a fuse of fine wire is added within the case. The vane suspension terminates beneath in a light metallic damper immersed in non-evaporating oil, so that the movements of the pointer are practically deadbeat.

As the instrument simply measures electrostatic force against gravity, there is nothing within its action liable to change with time, and there are no pivots to introduce friction. The advantage of a bifilar suspension is its independence of torsion and such errors as temperature or elastic fatigue in wires are capable of producing.

This instrument is well constructed mechanically. The base and frame of the instrument are of cast iron the cover of polished wood and the front of bevel glass. It is 11 inches high, 14½ inches broad and projects 13 inches from the wall. It is unaffected by the presence of heavy magnets, temperature or moderate vibration. In the 18 months since its introduction it has given satisfactory results.

The Standard Divider.

The illustrations given herewith represent a novel and most useful drawing instrument. Its field of usefulness is at once apparent to the intelligent draftsman, calculator and mechanic. It is made entirely of steel and in its construction the greatest care is exercised to make the instruments perfectly accurate and durable. For dividing a line into any number of equal parts it is quick and accurate in measurement. By the use of the vernier the exact length of each part is read to a fraction of the scale. For marking off a number of equal spaces or as a scale it is found very useful. In many instances it can be used in place of a proportional divider. For many other purposes it will also be found to save time and to accomplish the work to a fine degree of accuracy. The instrument is neatly finished, being nickel plated and is packed in a velvet lined case. It is manufactured by the Standard Divider Company of 359 Dearborn St., Chicago.

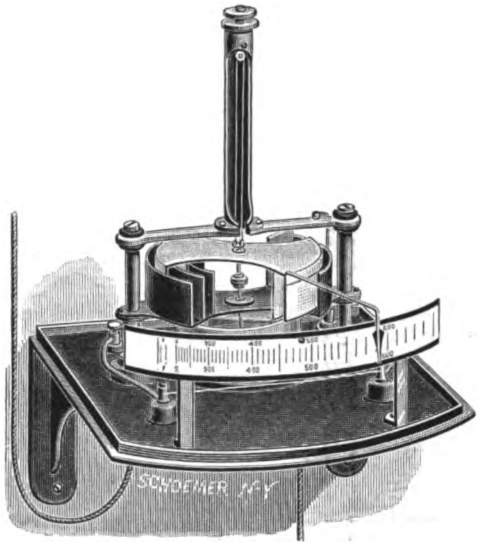
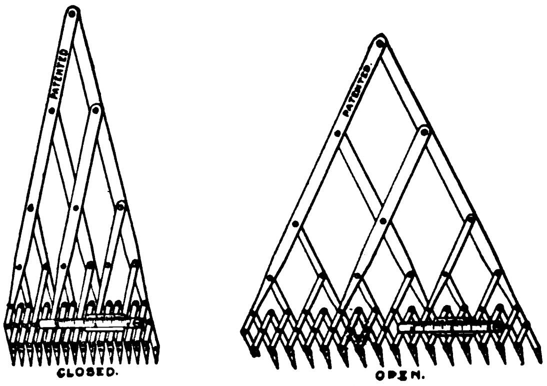


FIG 2.—THE KENNELLY STANDARD ELECTROSTATIC VOLTMETER

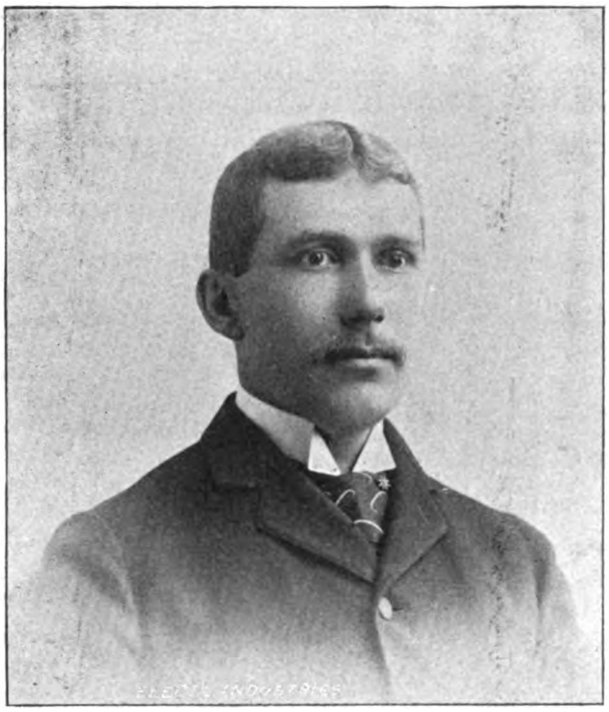


THE STANDARD DIVIDER.

An item having appeared in one of the electrical papers to the effect that Bartholemew, Stow & Co., Chicago, were in the hands of a receiver it is but justice to say, as we are informed by persons acquainted with the affairs of the company, that the company is entirely solvent, that no receiver has been or will be appointed, but on the contrary the firm are in a position to fill promptly orders from new as well as old customers.

The Metropolitan Electric Company.

The rapid extension and general adoption of electricity in its various applications has been one of the wonders of the present age. So thoroughly has it worked its way into the life of the nation that this is often called the electrical age. For this rapid progress we are greatly indebted to the supply houses and manufacturers of electrical apparatus who have acquainted the public with the special merits and advantages of electricity and placed within its reach the necessary machines and apparatus for the utilization of this force. Thus the manufacturers and supply houses have become important factors in the progress of civilization.



WILLIAM H. MC KINLOCK.

Among the more recently established houses is the Metropolitan Electric Company which has offices in the Monadnock Building, and warerooms at 307 Dearborn St. The Metropolitan company is made up of men who for years have been prominent in the electrical business. The company is but a new combination of familiar business men with whom the electrical industry, especially of the west is well acquainted.

Mr. William H. McKinlock, who is president of the company, has been actively engaged in the supply and manufacturing business since 1887. He began his business life with the Detroit Electrical works, and during the ten years he was connected with that company, occupied successively the positions of secretary and manager. Foreseeing the advantages of Chicago's position as a business center he wisely chose it his home. Although comparatively a young man he has for some time occupied a prominent place in this industry, with business relations which have not only extended over the United States but into neighboring countries. Handling nothing but standard goods and introducing nothing but specialties of merit a substantial business reputation was established.

Occupying a business position of this kind it would be hard to neglect his duties to society. In his handsome residence it has been his pleasure to entertain his large circle of friends and acquaintances. As a member of a number of prominent clubs he is often seen at their gatherings.

Under Mr. McKinlock's direction this new company at once assumes a prominent position among Chicago supply houses. Another member of the company, Mr. Walter C. McKinlock, is well known to the trade and especially in Chicago and St. Louis, in which cities he has for a number of years resided. He is secretary of the company and has had an extended experience in this line of business. As president and founder of the Enterprise Electric Company he made many friends and acquaintances who will be pleased to see the development of the larger company into which the Enterprise Company has been merged. His prominent connection with the different business houses has given him a standing which many an older business man has failed to obtain.

Power Plant of the Mather Electric Company.

In Machinery Hall, Section C, is located the power plant of the Mather Electric Company. It immediately attracts the attention of the visitor on account of its light color, the machines being finished in white and gold. To the street railway man it possesses many points of interest, as it is especially adapted for furnishing power for that class of work. And for operating motors for factory purposes, it is also adapted on account of its close regulation and high efficiency.

In this plant are four large generators, of which two are of 225 K. W. capacity, each working at a potential of 550 volts at 450 revolutions per minute. The other two generators which are compound wound like the proceeding have a capacity of 120 K. W. and are working at a potential of 550 volts at 525 revolutions per minute. The former generators are six pole machines, with field magnets and armature supports cast in one piece without joint, except between the upper and lower half of the field.

WALTER C. MC KINLOCK.

The winding of the armature is such that there are only two paths for the current through the armature, and yet opposite bars of the commutator are connected and so maintain the same potential. The commutators are cross connected, the opposite bars being maintained always at the same potential, so that it is possible to use either all the sets of brushes or any two sets, as may be desired. The generators are mounted on sliding iron bases fitted with four screws connected together in pairs by means of a chain, and operated by ratchets, so that the generator can be kept in perfect alignment and the tension of the belt regulated. These base frames are firmly bolted to the foundations.

Near the center of the space is placed the switch board, which is constructed of slate slabs set in steel frame, all of which is enclosed in a neat and ornamental frame, on the upper panel of which appears the name of the company. The four generators are connected to one set of bus bars on this switch board, so that all the machines may be operated in multiple if so desired. The switchboard contains four rheostats, four triple pole switches, through which the generators are connected to the bus bars; four ammeters, which record the quantity of current generated by each machine; one volt meter which is so connected by means of the company's improved switch that readings may be taken from either generator or from the bus bars by making the proper connection on the switch; one differential indicator which may be connected by means of the company's indicator switch to anyone of the generators when it is desired to throw one or another of the generators into circuit while one or more are in operation, and this instrument indicates exactly when the machine to be thrown into circuit attains the proper potential. There are also on the switchboard four double pole single throw switches, four ammeters, which show the quantity of current used on each circuit. These circuits are protected by means of double pole safety cut-outs which are provided with fusible strips of suitable capacity and are also further protected by means of automatic circuit breakers mounted on separate frames behind the switchboard. The bus bars and all the connections between the switches and instruments are of finely finished copper symetrically arranged on the back of switchboard and present a very neat appearance. These generators have been supplying the current for operating the motors in the Mines and Mining Building, Agricultural Building, for the movable sidewalk on the pier and also for the Mather Electric Company's exhibit in Electricity Building. The plant presents a neat and substantial appearance and is worthy of the attention of all power users.

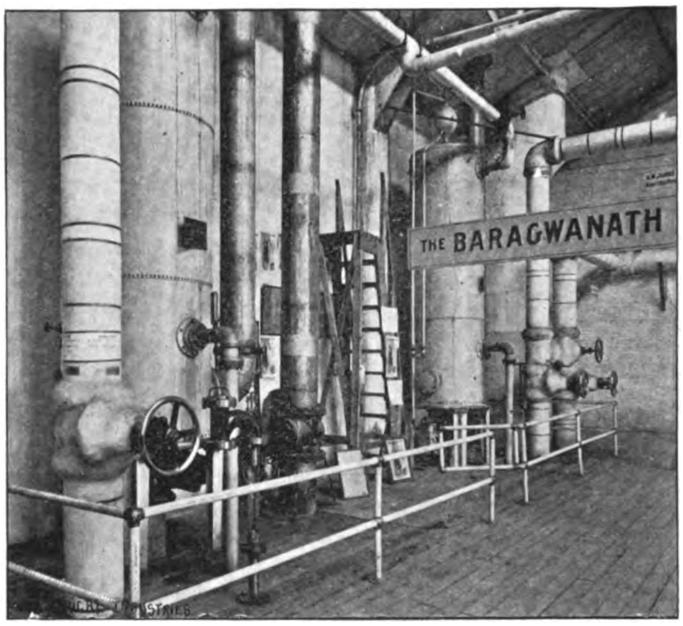
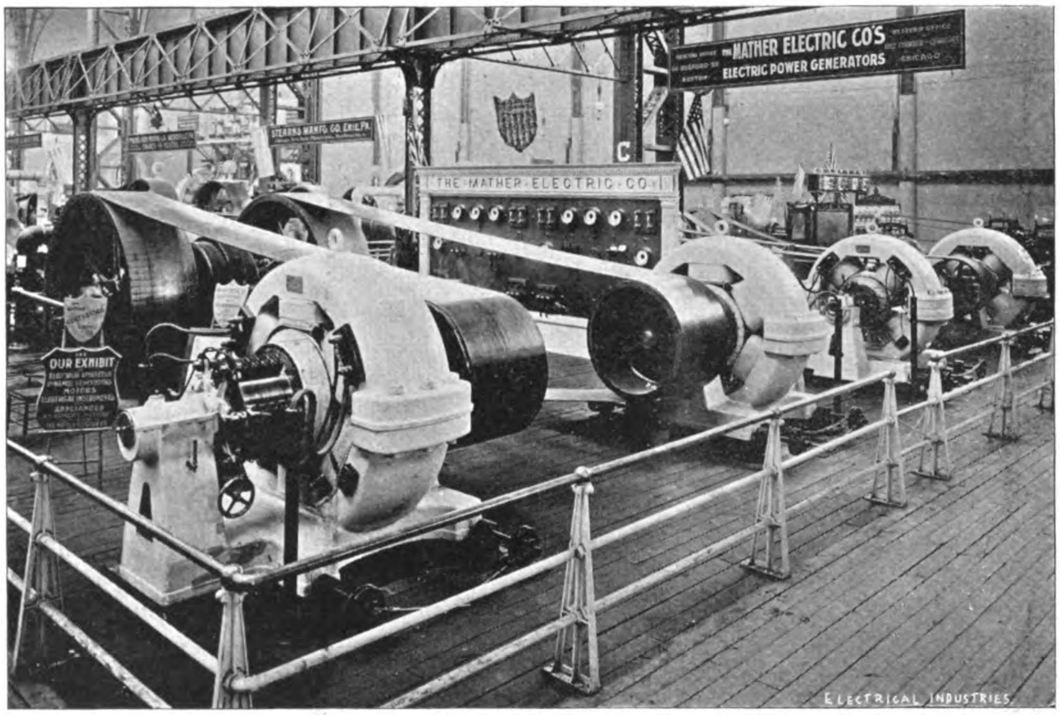


EXHIBIT OF BARAGWANATH FEED WATER HEATERS.



THE POWER PLANT OF THE MATHER ELECTRIC COMPANY.

Exhibit of Baragwanath Feed Water Heaters at the World's Fair.

A very practical exhibit of feed water heaters was made at the Fair by Wm. Baragwanath & Son, of Chicago. In the gallery of the main boiler room are placed two heaters of 500-horse power each which supply from 1,500 to 2,000-horse power of boilers. These are in constant operation and have been since they were installed. In the plant of the Wellington Catering Co., on the grounds one 300-horse power combined heater and receiving tank is in use. Two other heaters are used at the Exposition, one of 150 horse power at the power station of the Hygeia Co., and one of 200-horse power at the Libby Glass Works.

These feed water heaters possess many points of excellence and the special claims made by the manufacturers that it is the only one on the market using exhaust steam that will boil the water, and that it will not cause any increase in back pressure but acting rather as a surface condenser will reduce any back pressure that may exist, are worthy of attention. Another important point is the manner of construction which causes the impurities in the water to be precipitated to the bottom of the heater where they are easily removed, as the temperature of the water is raised. In this steam jacket heater the exhaust enters at the bottom of the heater and returns on the inside of the shell. This arrangement prevents any loss by radiation as the water is entirely enclosed within the chamber containing the exhaust steam. The feed water is fed in the lower end of the heater and drawn off at the upper. At the top is a device for collecting the scum and a valve for removing whatever scum may rise. Suitable hand holes and drips are provided to facilitate the cleaning of the heater and the removal of whatever precipitate and sediment which may have been separated from the feed water.

A horozontal pattern of the exhaust heater, a live steam purifier, a plain tubular heater and a triple acting power driven steam pump are also manufactured by this company.

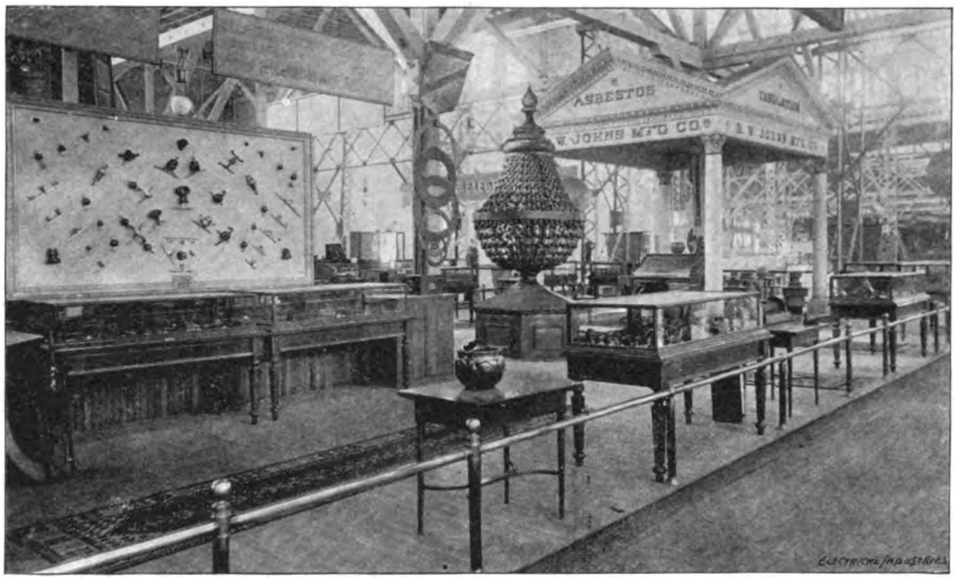
The Exhibit of the H. W. Johns Manufacturing Company.

One of the most important parts of every electrical machine and apparatus is its insulation and consequently to electrical manufacturers and users of manufactured articles the exhibit of the H. W. Johns Mfg. Company has been very interesting. It is located in the west gallery of the Electricity Building and is quite conspicuous on account of the large white balls mounted on posts and placed at the corners of the space and also the large pavilion finished in white and gold in the center of the space.

The illuminated sign which flashes out the name of the company and then the word "insulation" in red lamps attracts the attention of visitors on the ground floor. Placed about the exhibit are a number of unique objects constructed of various insulating pieces manufactured by the company. On an oak stand just south of the pavilion is an urn-shaped arrangement of strain insulators made of moulded mica, of which it required nearly 1,000 to complete the figure. Just beyond this are some large panels on which are displayed trolley line appliances in which moulded mica is used as an insulator.

The illustration shows the prominent position occupied by a large board which contained samples of all the latest pieces of trolley line insulators sold by the company.

In the case at the end of the exhibit is shown asbestos in the form of gaskets, washers, various forms of packing, etc. In another case are displayed incandescent lamp sockets, rosettes, etc., of moulded mica. Several insulators are shown in another case cut in two, so that the relative position of the insulation and metal is shown. Armature rings in a great variety of forms and shapes of valcabeston are shown as it is used in connection with numerous electrical devices. Near the center of the exhibit are shown an Excelsior Gramme ring armature, field magnet spools, etc.



THE EXHIBIT OF THE H. W. JOHNS MANUFACTURING COMPANY.

Although the exhibit covers an extensive field it is but a part of the exhibit of the H. W. Johns Mfg. Company at the World's Fair, the Company having six exhibits in four of the Exposition buildings. A visit to Machinery Hall and the boiler plant shows the visitor an application on a large scale of the boiler steam pipe coverings as used in electric light and power plants.

The Antwerp Exposition which is to open at Antwerp, Belgium, May 5th, 1894 has brought into existence the American Propaganda which has for its object, the presentation of American industry at foreign expositions. It also acts as commercial agent for exhibitors and will collect and install exhibits and statistics such as will present the country's resources and products in a creditable manner. A building is to be erected called the American Propaganda Building for these exhibits and statistics, and which will also afford a headquarters for American visitors. This building is to be constructed in a way that will admit of its being taken down and moved, if it is desired to use it at more than one exposition.

A BREIF REVIEW.

A machine has recently been devised by Mr. C. S. Bradley by which currents of high potential may be generated without the injurious effects to the commutator on account of the great difference of potential of the neighboring brushes. The Electrical Engineer describes the machine as follows: "The inventor has adopted the ingenious plan of mounting upon the same shaft an armature wound with a number of independent circuits, all of which contribute to the resultant effect through the medium of a number of commutators, the brushes of which are coupled together in such a way that the several windings will be in series relation to one another. The dielectric strain upon the wire insulation is reduced by connecting some intermediate point of the internal circuit with the frame of the machine. The windings are highly insulated from each other and so arranged that parts of the windings which lie in close juxtaposition upon the armature will have as low a difference of potential as is compatible with a symmetrical system of winding. Each commutator has a large number of segments in order that the potential difference between any two adjacent ones may be as small as possible and yet the aggregate difference at the brushes may be high. Each has a pair of brushes. Two brushes of opposite sign are connected together and the remaining two are connected to the terminals of the machine. There will thus be thrown upon the line a current having an E. M. F. behind it equal to the sum of the E. M. F.'s developed by the two windings, and the dielectric strain between the frame of the machine and the windings would be equal to the aggregate E. M. F., a condition which it is very necessary to avoid, inasmuch as the insulation of that portion of the winding where the potential is highest is liable to rupture. In order to avoid this difficulty Mr. Bradley connects the frame of the machine with some portion of the circuit between the line brushes, so as to raise the potential of the machine and thus lower the dielectric strain by connecting the two brushes which interlink the two windings by a good, firm connection with the base of the machine. Thus if each winding develops an E. M. F. of a thousand volts, the frame of the machine will be brought to a potential of 1,000 volts and the strain upon the insulation will only be the difference between the final E. M. F. or 2,000 volts, and 1,000 volts, or just one-half of what it would be without the base connection. In mounting the machine care is taken to highly insulate it from the earth in order to prevent leakage from the base, which, under the system of connections described, will have a considerable potential."

There has been a movement among the insurance associations both in the east and west toward the increase of rates and the same excuses are offered in each case which are found in the following from a recent issue of the Electrical Engineer. "Considerable feeling and interest has been aroused at Providence, R. I., by the announcement of a 20 per cent advance in fire insurance rates based largely if not wholly upon the greater dangers alleged to be due to the increasing use of electricity and the multiplication of electrical wires in the streets. It appears that the assessors' figures for 1892 show the valuation of real estate in Providence to be $114,656,860. If this property is insured at 75 per cent of its value, the insurance risk would amount to $85,992,645. The average rate of insurance being about 1 per cent, property owners pay annually $859,926. An increase of 20 per cent will increase that amount by $171,985. This is no mean increase, and the community is said to be greatly agitated on the subject. Nor does Providence stand alone in this respect. Rates are being raised in a similar manner all over the country, and in every instance, so far as we are aware, electricity is the bugaboo of the underwriter. What are we going to do about it?

"Now, admitting that the underwriters have only seized on electricity as a pretext for higher rates because the fire insurance business has been in a rotten condition that dates back far beyond the introduction of electricity for light or power, duty requires that the facts supporting these charges as to the dangers of electricity should be dealt with. The silver purchase law has not been the only cause of recent financial trouble in this country, but once repealed, it will be easier to restore public confidence and deal with other evils. So, too, with the indiscriminate stringing of electrical wires. If the underwriters can be met on their own ground, and the abuses they complain of be removed, the way to lower, healthier rates will be easy, and the deserved popularity of electricity will be greater than ever.

"First of all, there are, as the underwriters contend, far too many overhead wires in the streets. There should not be allowed a single telegraph, telephone or signal wire overhead in any large city in the country. They can be better and more continuously operated underground than overhead, and no plea for aerial wires along or across streets should be listened to. That large class of wires disposed of, simply the electric light, electric power, and electric railway circuits are left, all of which are of stronger construction than the first class, and will be far less liable to give trouble when their fragile companions are removed. But it cannot be denied that to-day many of the wires in this second group can be put underground. It settles down in most places to a mere question of expense and return on investment.

"Up to the present time, the trolley electric railway system has maintained its position because it is an enormous public convenience and because there is nothing yet ready of approved ability to take its place. We believe, moreover, that were there no overhead telegraph or telephone wires, the trolley would not be and could not be the cause of a single fire. In some places, stationary power motors are run off the 500-volt railway circuits, but in those cases ordinary precautions should suffice, and if they did not an advanced rate would be fair. Until storage battery traction or underground conduit systems are perfected, the trolley wires will increase in proportion to the increase of population; but in themselves they are no greater enemy of life and property than are the elevated roads.

"When we come to interior wiring we find a state of affairs much to be deplored, but even here marked improvement is to be seen, and the raising of rates will only help the good work along. One step should be insisted on and that is the cessation of the practice of putting wires in plaster. They should be permitted only in tubes or moulding, and whenever they go in the walls they should run through tubes. We are ready to favor strong legislation compelling the use of wireways in buildings, and are glad to note that the Underwriters' International Electric Association have just placed themselves on record in support of insulating wireways that render concealed wiring permanently accessible.

"The best way to meet the underwriters and their advancing rates is to deprive them of even the few arguments they now find against electricity in the cheap and bad work done."

The Statement of the Ansonia Electric Company.

The Ansonia Electric Company recently issued to its creditors the following circular giving a statement of its affairs: There has been a necessary delay in submitting a full statement of our affairs owing to the large number of open accounts (some three thousand) which we wished first to carefully check up, and adjust any proper differences that might exist. The following is an approximate statement of the condition of the company when the receiver and assignee took possession of its affairs:

ASSETS.

Plant, real estate appraised (subject to mortgage of $20,000)	$40,200.00	
Machinery appraised	22,161.36	
		$ 62,361.36
Stock as appraised		93,447.56
Bills and accounts receivable, considered collectible		145,000.00
Total		$300,808.92

LIABILITIES.

Accounts and bills payable (including mortgage loan)	$284,000.00

CONTINGENT LIABILITIES.

Indorsement on customers' notes	$58,000.00
	$342,000.00

Of the customers' notes indorsed by us, $20,518.31 have been protested, and we have advices showing that $11,000 more will be protested. Of this it is impossible to say what amount can be ultimately realized, and on a large part of it we can hope to realize but little, and consequently it will become the indebtedness of this company.

The above statement does not include fixtures of Chicago store, patents, trade-marks, etc., which are of value to the business if continued, but for which little or nothing could be realized if sold; nor does it include what may be realized from accounts which are at present not considered good. The accounts receivable and payable may vary slightly from the above.

It is probable that little could be realized from the equity in the real estate should the property be sold; and the machinery has but small value excepting in the event of the continuance of the business.

The stock of merchandise consists of a large variety of articles which can not readily be sold, nor could it be disposed of excepting in the ordinary channels of trade, without very great sacrifice. Experience has shown that where an estate goes into liquidation there is a disposition on the part of the debtors to take advantage of the conditions, and return goods or put in claims for allowances and deductions in making settlements, thus causing much loss and adding to the expense of realizing on the accounts. The nature and condition of the assets have been very fully canvassed with the view of deciding what in the end would prove to be for the best interest of the creditors; and taking the experience of others who have passed through liquidation as a guide, it would appear doubtful if over 30 per cent of the claims could be realized were the estate to be closed out. If the business can be continued a value could be attached to some assets which would otherwise prove worthless, and an increased value given to others, and the stock could all in time be disposed of to advantage, and the expenses of collecting accounts and disposing of the stock would come out of the regular income of the business. After consulting some of our largest creditors, we have decided to offer to our creditors a proposition securing 60 per cent per cent of their claims, which proposition we could carry out, and which would give us an opportunity to save a valuable trade and again build up the business. As this proposition involves the assumption by the company, not only of the expenses of selling the goods and collecting the accounts, but also all the expenses of courts, attorneys, assignee, receiver, etc., already incurred, and the compensation of the trust company, it is necessary, if it should be carried out on the basis proposed, that the same be promptly accepted and the expenses put under its control.

The company can not carry through the payment of a larger percentage, and we commend to your kind consideration the above proposition, which we feel positive will result in the largest return to the creditors that can be realized in any way.

CONVENTION NOTES.

The Hale & Kilburn Mfg. Co., Philadelphia, made a display of car seats of several styles.

The Lamokin Car Works, Philadelphia, was well represented by Messrs. Pratt and Cochrane.

Mr. J. H. Stedman, Rochester, N. Y., was on hand with several new styles of transfer tickets.

The Garton-Daniels Electric Co., Keokuk, Iowa, had several of their lightning arresters on exhibition..

The Curtis Electric Motor Co., Jersey City, had a truck equipped with the Curtis motors on exhibition.

The Detroit Electrical Works, Detroit, Mich., was represented by its secretary, Mr. Jos. E. Lockwood.

The Graham Equipment Company, Boston, Providence and Chicago, were represented by Mr. J. H. Graham.

The Pawtucket Brass Foundry, Pawtucket, R. I., showed motor bearings of its manufacture of several sizes.

The Davis Car Shade Company, Portland, Me., had a number of shades on model frames showing their operation.

W. L. Adams & Company, Chicago, was represented by Mr. W. L. Adams, who called attention to his specialties.

Mr. C. S. Van Nuis, of New York, was present and distributed a great many fac simile Ajax lightning arresters.

The Pinkham Car-Track Sander Co., of Boston, Mass., displayed in the exposition building its electric sand box.

The Gibbs Electric Company, Milwaukee, had several trolleys complete, trolley wheels and line supplies on exhibition.

The Taylor Electric Truck Co., Troy, N. Y., had on exhibition a Taylor truck and was represented by Mr. Taylor.

The Burrowes Car Shade Co., Portland, Me., was represented by Mr. John W. Baker, who had a number of shades on exhibition.

L. Katzenstein & Co., New York, had on exhibition a number of journal boxes, showing the use of Katzenstein's metallic packing.

The Johns-Pratt Manufacturing Company, Hartford, Conn., made a display of some of its specialties. Mr. Edw. Hatch was present.

The Walker-Marshall Automatic Switch Co., Milwaukee, made an exhibit consisting of the Walker-Marshall automatic switches.

The American Arch. Iron and Brass Works, Chicago, displayed Robinson trolley wheels of which this company are the manufacturers.

Mr. W. E. Ludlow, Cleveland, Ohio, displayed a new combined step and gate. When not used for a step it acts as a gate and vice versa.

The Cutter Electrical & Mfg. Co., Philadelphia, had an exhibition board erected on which were displayed magnetic cutouts, rheostats, etc.

The Western Electric Company, Chicago, made a display of wires and cables for electric railways. Mr. H. C. Eddy had the exhibit in charge.

The R. D. Nuttall Co., Allegheny, made an exhibit of gears, pinions and trolleys of the design which has become well known to street railway men.

The Edison Mfg. Co., of New York, had on exhibition a number of Kennelly standard volt meters showing the construction and points of excellence.

The Empire State Radial Truck Company, Cleveland, Ohio, had trucks on exhibition. Mr. Pfetsch of the company was present at the convention.

Harrison & Carey, Chicago, agents for the W. T. C. Macallen Co., of Boston, had on exhibition circuit breakers, cross overs and general line supplies.

The Tousley Trolley Company, Chicago, had on exhibition its self lubricating trolley which is claimed to possess several new features of excellence.

The Miamisburg Electric Company, Miamisburg, O., was well represented by Mr. D. H. Allen, general manager and A. L. Daniels, salesman of the company. The exhibit made at the exposition building was comprehensive, showing to good advantage the specialties made by the company, consisting of pure tempered copper commutatorbars and segments, Burnley dry batteries, etc.

Washburn & Moen Mfg. Co., Worcester, Mass.,made through its Chicago representative, Mr. H. B. Cragin, quite an elaborate exhibit of trolley and feeder wires.

The Link Belt Machinery Company, Chicago, had on exhibition besides the regular line of goods a new friction clutch which attracted a good deal of attention.

The Reliance Gauge Company, Cleveland, was represented by Mr. G. B. Clark, who had on exhibition a Reliance safety water column and distributed printed matter.

The Baltimore Sand Box Co., Baltimore had sample sand boxes on exhibition, placed on a section of car platform showing their operation both by hand and foot levers.

The St. Louis Car Co., St. Louis had several cars on exhibition. The two placed opposite the 5th St., entrance of the exposition building attracting considerable attention.

The Railway Equipment Company, Chicago, had very pleasant headquarters at the Plankinton Hotel. Mr. W. R. Mason, manager of the company was in attendance.

The P. Wall Mfg. Supply Co., Alleghaney City, Pa., made an extensive exhibit of street car gongs. Mounted on a display board were arranged gongs in various sizes and kinds.

The International Electric Company, Detroit, Mich., had on exhibition an electric heater that it is exploiting. The secretary of the company, Mr. A. S. Hatch, was present.

Chas. A. Schieren & Company, New York, made an exhibit through its Chicago branch of belting, especially adopted for electric railway service. Mr. R. W. Grant was in charge.

The Consolidated Car Heating Co., Albany, N. Y., was represented by Mr. McElroy. The exhibit made of car heaters was of the practical order and received considerable attention.

Fairbanks, Morse & Co., Chicago, displayed railway supplies. The exhibit of lifting jacks was quite extensive, showing jacks of several styles together with a number of models.

The National Time Recorder Co., Milwaukee, had a Bolte automatic time keeper on exhibition showing its operation as used in connection with street railway systems, factories, etc.

Chas. Munson Belting Co, Chicago, was well represented by Mr. W. C. Groetzinger and Mr. J. H. Shay. The display of belting comprised samples of the various kinds manufactured.

The Superior Machine Company,Cleveland, Ohio, had a number of gears and pinions on exhibition which the company manufactures in standard sizes for the different kinds of motors.

The Vose Spring Co., New York, was represented by Mr. Gus. Suckow, sales agent, who was on the lookout for new orders. A number of trucks displayed were fitted with the Vose springs.

The St. Louis Register Company, St. Louis, was represented by Mr. Gardner McKnight. The exhibit of registers in the exposition building was attractive and showed to advantage their general use.

Wm. Wharton,Jr. & Co., Baltimore, engineers, founders and machinists, made an exhibit of track material and gave out neat pamphlets calling attention to their extensive exhibit at the World's Fair.

The New Haven Car Register Co., New Haven, Conn., was represented by Mr. A. N. Soper who had a display of a number of the New Haven registers which possess several novel and interesting features.

Wadhams Oil & Grease Co., Milwaukee, Wis., called the attention of the delegates in many ways to Wadham's graphite curve grease which is particularly intended for use on electric and cable railways.

The Cutter Electrical & Manufacturing Company, Philadelphia, was represented by Mr. Cutter, who had with him a switchboard on which was arranged an exhibit of lamps and magnetic cut-outs.

The Robinson Machine Company, Philadelphia, had on exhibition one of its latest style of trucks which attracted considerable attention. Mr. Albert E. Hay, president of the company, was in attendance.

The Jewell Belting Company, Hartford, Conn., made an exhibit of the well-known Jewell belting which is extensively used in street railway power plants. The company was represented by Mr. Chas. E. Newton.

The Stirling Supply Company,New York, had on exhibition car beaters, sand boxes, etc. Mr. John Kennelly, chief engineer of the company and Mr. Howard Wheeler representative were looking after the interests of the company.

Mr. F. E. Carleton, representing the lubricating department of the Standard Oil Co., at Milwaukee, had an exhibit of samples of armature and curve greases, cylinder oils and lubricants of several kinds, also parafine for insulation.

H. W. Johns Mfg Co., New York, made a display of line materials and supplies. Mr. H. A. Reeves, manager of the electrical department, Chicago, and Mr. W. F. D. Crane general manager of the electrical department, New York, were present.

The Pullman Company, Chicago, had as its exhibit the 100 closed and open cars recently built for and now in operation on the Milwaukee Street Railway lines. Mr. W. S. Louttit, the assistant contracting agent, was present during the convention.

The Hartford Woven Wire Mattress Co., Hartford, Conn., had a number of car seats displayed showing the construction of its spring seats. Mr. H. F. Evans western agent with headquarters at St. Louis was looking after the interests of his company.

The Western Electric Heating Co., Chicago had a number of electric heaters in operation about its booth. Mr. Geo. Cutter the manager was present and the interests of the company were well cared for. The exhibit attracted a great deal of attention.

Jones & Laughlin, Lim., Pittsburgh and Chicago, had on exhibition a number of steel axles of which the company makes a specialty. Many of the axles had been tested in various ways and showed the excellent quality of the material used in their construction.

The Peckham Motor Truck & Wheel Co., New York, was represented by its president, Mr. Edgar Peckham. The extra long 6 D truck exhibited by this company attracted considerable attention. It was equipped with G. E. 800 motors and stood ready for the car body.

The Cudahy Lubricating Company, Milwaukee, had samples of Kent's motor grease in several forms. Mr. H. W. Kent, the general manager, was looking after the interest of his company and the street railway men have undoubtedly become familiar with another kind of lubricant.

The Eureka Tempered Copper Co., North East, Pa., had a very fine line of copper commutator bars, pinions, etc., on exhibition which showed both the character and quality of the goods manufactured. Mr. Alfred Short, president of the company, was in attendance at the convention.

The Stanwood Manufacturing Company, Chicago, displayed several steel steps of its manufacture in the exposition building and as a practical exhibit called attention to the large number of steps in use on all the lines in Milwaukee. The president of the company, Mr. F. H. Stanwood, was present.

The Standard Railway Supply Company, Chicago, made an elaborate display of street car stoves, together with a new line of overhead railway material that was especially fine and attracted much attention. Mr. Garson Myers, the general manager of the company, and Mr. McDonald were present.

The Rochester Car Wheel Works, Rochester, N. Y., made an extensive exhibit of car wheels of all kinds. Mr. F. D. Russell,general manager of the street railway department, and Mr. Eldridge Packer, general sales agent were present looking after the interests of their company.

The McGuire Manufacturing Company, Chicago, had one of its Columbian trucks on exhibition, over which hung the blue ribbon showing the award received for it at the World's Fair. The company also called attention to the large number of trucks in use on the different lines in Milwaukee. Messrs. McGuire, Cooke and Hubbard were present.

The Mosher Electric Company, Chicago, had as its exhibit 10 arc lamps burning in the exhibition hall in series on a 500 volt street railway circuit. The quality of light and steadiness of burning was a subject of much comment from street railway men present. Mr. J. A. Sheriff was in attendance, the installation of the exhibit having been made by Mr. Mosher, the inventor of the lamp. These lamps, after the convention, were shipped to the Cleveland Electric Railway Company to which company they were sold.

Bartlett & Company, New York, distributed some very handsome souvenirs in the shape of a little pamphlet entitled a "Modern Triumvirate" containing some very fine engravings. The press work is excellent and the embossed cover handsomely designed. The trumvirate is represented on this cover in the heads, representing the artist, the engraver and the printer.

General Electric Company, New York, made an extensive exhibit of trolley and line supplies. Mounted on a Peckham truck were exhibited G. E. 800 motors. Representatives from the main office in New York, from the Cincinnati office and also from Chicago and San Francisco offices were present. An illuminated sign was one of the attractive features of its offices in the Pfister Hotel.

The J. G. Brill Company, Philadelphia, had a number of trucks and sections of cars, showing the construction, on exhibition in the exposition building. The double decked car that made regular trips between the exposition building and Pfister Hotel for the accommodation of delegates undoubtedly attracted the most attention. Mr. J. Randell and Mr. J. C. Brill were present at the convention.

The Siemens & Halske Electric Co., Chicago, had one of the most practical exhibits made. In a tent at the side of the exposition building there was operated a complete power plant. A Buckeye engine was directly connected to a Siemens & Halske generator. The plant was built for Cincinnati and set up temporarily before being shipped to that point. It received a constant stream of visitors.

The Paige Iron Works, Chicago, made an extensive exhibit of railway crossings, trails, girder rails, switches, etc. A business card of the company on the back of which was a map of the business center of Milwaukee was found very useful by the delegates. Mr. A. W. Paige, the president of the company, Mr. George Low, superintendent, and Mr. G. F. Starkweather, manager, were in attendance.

The Mica Insulator Co., New York, had one of the most complete exhibits in the exposition building. An illuminated sign was one of the attractive features of the display. Micanite was shown in a great variety of forms: in boards, in the required shapes for insulating commutator segments, armature coils, etc. A very neat souvenir was distributed, consisting of a card on which was mounted a piece of Micanite, in the shape of a commutator bar. Mr. Chas. W. Jefferson, manager of the company, was in attendance.

The Westinghouse El. & Mfg. Co., occupied a very prominent office on the main floor of the Pfister Hotel, accessible both from the street and the lobby of the hotel. A display of railway material was made there, consisting of the new series multiple controller for electric railways, lightning arresters, for power stations and various supplies. Representatives from the eastern and Chicago offices were present. A very neat souvenir was given away in the shape of a book of testimonials of its railway apparatus, through which are placed views of many prominent electric roads.

FINANCIAL.

A slight improvement has been noticed during the past month in the financial situation. The repeal of the silver purchase law has settled the money standard of the country and placed it on the same basis as that of other great commercial nations. Its effect on securities was but slight, the result having been anticipated.

The last of the Boston clearing house certificates have been canceled, and nearly all of the New York certificates. Thus this evidence of the money stringency of the past summer will soon be wiped out.

The gradual appreciation in the price of stocks continues, and the outlook for still further advance is good. Electrical stocks and securities have felt the general advancement. The stock of the General Electric Company remains about 50, although the dividend has been passed. It is the policy of the management to curtail as far as possible the expenses and to husband its resources. The company is said now to be making money, but it will require a considerable to make good the losses during the late depression. In accordance with a circular recently issued, 90,000 shares of the stock of the "Electric Railway and Illuminating Properties," which was formed to underwrite the floating debt of the General company, taking in return the stocks and bonds which now form the assets of the company, are offered to the present stockholders of the General company. This stock consists of 45,000 shares of six per cent preferred stock and a like amount of common.

The stock and bonds of the Westinghouse company have experienced a sharp advance during the past month or two. This has been due both to the general advancement and to the fact that the company has received several large orders, among which is an order for three large generators from the Cataract Construction Company, the Tesla two-phase alternating system having been adopted by that company.

Name of Company.	Description of Security.	Amount Issued.	Par Value.	Rate Int.	Date Payable.	Closing Oct. 28
Miscellaneous Securities.						
American Bell Telephone Co....	Stock.	$17,500,000	100	....	J. Q.	193
" " "	Bds. 1893.	2,000,000	100	7	F. & A.	107
American Tel. & Cable Co... ...	Com.	14,000,000	100	....	....	90
Commercial Cable Co	Com.	7,716,000	100	....	....	120
Edison Elec. Ill. Co., Boston....	Com.	2,025,800	100	....	F. Q.	124
" " " ...	C.Bds. 1898.	71,000	100	6	M. & S.	.....
" " "	C.Bds. 1901.	586,500	100	6	M. & N.	......
" " Brooklyn..	Com.	2,500,000	100	....	Q. F.	85
" " " ..	1st. 1940.	500,000	100	5	A. & O.	......
" " " ..	Regis.	....	100	5	A. & O.	......
" " Chicago...	Com.	3,000,000	....	8	Q. F.	.....
" " "		2,500,000	....	....	....	.....
" " New York.	Com.	7,938,000	100	....	Q. F.	97
" " "	1st 191 .	2,562,000	100	5	M. & S.	100
" " Phila......	Com.	1,473,000	100	...	....	120
" " "		... .	....	5	....	......
Fort Wayne Elec. Co...... ...	Com.	4,000,000	25	....	....	5
General Electric Company.	Com.	30,457,000	100	....	......	49
" "	Prf'd.	4,251,900	100	....	....	71
" "	Deb. 1922.	10,000,000	100	5	J.-D.	76
Gold & Stock Tel. Co...........	Com.	5,000,000	100	....	Q. J.	... .
Northwestern Gen. Elec. Co.....	Com.	1,000,000	100	....	....	......
" " "	Prf'd.	750,000	100	....	J. Q.	......
Thomson Elec. Welding Co......	Com.	1,000,000	100	....	....	......
Thomson European Welding Co.	Com.	1,500,000	100	..	....	......
Thomson-Houston Elec. Co . .	Series D.	1.0,000	10	....	....	5⅜
Thom'n-Houst'n Intern. Elec. Co.	Com.	600,000	100	..	....	.....
" " " "	Prf'd.	400,000	100	....	....	......
United Electric Securities Co....	Com.	1,000,000	100	....	....	......
" " "	Prf'd.	1,000,000	100	....	F. & A.	....
Western Union Tel. Co..........	Com.	94,820,000	100	....	Q. J.	92
" "	Var. Issues	13,088,000	100	7&5	M. & N.	......
West'gh'se Elec. & Mfg. Co	Ass' ing.	5,333,940	50	....	....	27
" " "	1st Pf.Cum.	3,755,700	50	7	....	45
Electric Railway Securities.						
Brooklyn—						
Brooklyn City R. R.............	Com.	6,000,000	10	....	Q.-J.	170
" "	1st Bds. 1916	3,000,000	100	5	J. & J.	90
Coney Island & Brooklyn R. R..	Com.	500,000	100	....	Oct. 1.	.....
" " " ..	1st Bds. 1909	300,000	100	5	J. & J.	.....
" " " ..	Certf. 1894.	300,000	100	6	J. & J.	.....
Buffalo—						
Buffalo St. Railway.............	Com.	5,370,500	100	5	....	......
" "	Bds. 1931.	5,000,000	100	....	F. & A.	......
Boston—						
West End St. Railway...........	Com.	9,085,000	50	..	J. & J.	58
" "	Pf'd.	6,400,000	50	5	J. & J.	80
" "	Bds. 1902.	3,000,000	100	....	M. & N.	.....
Louisville—						
Louisville St. Railway Co........	Com.	5,000,000	100	....	....	......
" "	Prf'd.	1,000,000	100	5	A. & O.	.....
" "	1st Bds. 1930	6,000,000	100	....	J. & J.	......
Newark, N. J.—						
Newark Passenger Railway......	Com.	6,000,000	100	....	....	27⅜
" "	Bds. 1930.	6,000,000	100	5	J. & J.	84½
New York—						
Union Railway Co	Com.	2,000,000	100	....	....	155
" "	Bds.	2,000,000	100	...	....	......
Pittsburgh—						
Duquesne Traction Co........ ...	Com.	3,000,000	50	...	....	24
" "	Bds. 1930.	1,500,000	100	5	J. & J.	98
Fed. St. & Pleas. Val. R. R.......	Com.	1,400,000	50	....	J. & J.	19
" " " " "	Bds. 1919.	1,250,000	100	5	J. & J.	100
Pittsb'gh, Aleg. & Man. R. R....	Com.	3,000,000	50	....		38
" " "	Bds. 1931.	1,500,000	100	5	J. & J.	100
Pittsburgh & Birming. R. R....	Com.	3,000,000	25	....	......	18
" " "	Bds. 1929.	1,500,000	100	5	M. & N.	98
Rochester—						
Rochester Railway Company....	Com.	5,000,000	100	...	....	......
" " "	Bds. 1930.	3,000,000	100	5	A. & O.	95
St. Louis—						
Lindell St. Railway.............	Com.	2,500,000	100	....	Q.-J.	60
" "	Bds. 1910.	1,500,000	100	5	J. & J.	97
St. Louis & Suburban...........	Com.	2,500,000	400	....	....	50
Union Depot Railway...........	Com.	1,200,000	100	...	....	......
" " "	Bds. 19 0.	1,000,000	100	6	A. & O.	100

* And interest bid.

NEW BOOKS.

Proceedings of the Third Convention of the Canadian Electrical Association. Toronto, 1893: Canadian Electrical News Press; 66 pages, paper covers.

This volume contains the complete minutes of the convention, the papers with the discussions read at the third convention of the association, and also a list of officers and members of the association. It is of convenient form for filing and arranged for easy reference.

Production of Coal in 1892. By E. W. Parker. Issued under the direction of the Department of the Interior. Washington, 1893: U. S. Government Printing Office; 300 pages, paper.

To persons interested in the coal trade, its production and distribution, the consumption and price, this volume contains a large amount of information. It also contains a description of the different coal fields of the United States and the proportion of the different kinds of coal mined from each field, etc.

Continuous Current Dynamos and Motors: Their Theory, Design and Testing. An elementary treatise for students. By Frank P. Cox, B.S. New York, 1893: The W. J. Johnston Co., Ltd., 41 Park Row; 271 pages, 35 illustrations. Price, postpaid, $2.00.

The first four chapters of the work might be considered as an introduction to the subsequent part, consisting of a review of the electrical units and general principles of the machines. Chapter V. is devoted to calculations pertaining to the magnetic circuit, and the following chapters to the designing and testing of dynamos and motors, except chapters XIII. and XIV., which consider indicator diagrams and steam engine calculations. Although these subjects are not electrical, they are so closely allied with the practical side of the subject their discussion forms an interesting part of the book. The volume is not intended for advanced students and scientists, but for students in their earlier studies and persons who have not secured a thorough training in electrical studies.

TRADE PUBLICATIONS.

The Shawmut Fuse Wire Company, Boston, issued recently a pamphlet calling attention to its fuse wire and fuse links. It also contains an article on "Fuse Wire and Its Use" which, although not new, is worthy of a perusal.

A very handsome souvenir of the recent convention at Milwaukee was the collection of plates very neatly bound together with a handsome silk cord and tassels. The plates contained half-tone engravings of views of the power house of the Milwaukee Street Railway Company and Edison Illuminating Company, which made it a valuable souvenir of the city and the convention.

A very neat blotter on the glazed face of which appears a list of representative plants installed by H. Ward Leonard & Co., New York, has been received. The list includes a great variety of kinds of electric plants and were installed over a considerable territory. The face of the blotter is of fine quality of glazed paper while the reverse side is of convenient blotting paper.

Under the title of the Central Valve Engine, the M. C. Bullock Mfg. Co., of Chicago, have issued a very handsome souvenir of the Fair. The book contains valuable information and descriptive matter, half-tone engravings of exhibits at the Fair and also views of numerous plants in which the Willans engines have been installed. A very fine quality of paper has been used making the cuts show to the best advantage.

Announcement of the Correspondence School of Technology is the title under which a small pamphlet appears. It contains a list of courses, a description of the methods of instruction and other information respecting the new school recently established at Cleveland, Ohio. The courses include applied electricity, steam engineering, railroad, bridge and civil engineering and architecture. The pamphlets are mailed on application.

An illustrated catalogue and price list has recently been issued by the Iona Mfg. Co., of Boston, in which the well-known specialties of the company with the addition of a number of new ones are shown and prices listed. It is compactly arranged and still shows the specialties in detail, but leaves the buyer to select from the very clear cuts the goods he desires. The advantages of this style of catalogue seem to be well understood by this company.

A handsomely printed catalogue was issued by Sautter, Harte et Cie of Paris containing notes on their extensive exhibit at the Fair. The matter is printed in French and English in parallel columns. The paper is heavy and of an excellent quality, and taken altogether makes a very fine catalogue. The exhibit of this company at the Fair was quite extensive and this catalogue presented in a comprehensive manner the manufactures and greatly aided a visitor in understanding the exhibit.

A magnificent catalogue of electric railway motor and trolley equipments was recently issued by the General Electric Company. It is entitled, "A Spin with the G. E. 800." The motor is described in general and illustrated in detail. The different methods of attaching to trucks is shown and also method of connecting. The series parallel controller and the numerous kinds and styles of trolley and line materials are shown in detail. In connection with some remarks on power station several views of the Intramural are given. The book concludes with a number of pages of letters from street railway managers given their opinion of the equipment of their lines.

PERSONAL.

Mr. Samuel Little has been elected president of the West End Street Railway, Boston.

Mr. Allen R. Foote of Takoma Park, D.C., called on Electrical Industries on October 22d.

Mr. E. R. Gilman, general manager of the Great Western Manufacturing Company, has just returned from a trip in the northwest.

Mr. W. C. McKinlock, of the Metropolitan Electric Company is just recovering from a slight illness which confined him to his house for a few days.

Mr. Charles Wirt, late electrical engineer of The Ansonia Electric Co., has opened an office as consulting engineer at 56 5th Ave., Chicago.

Nr. C. D. Crandall, manager of the Western Electric Company, Chicago, returned recently from a two week's business trip in the east, having visited New York and Philadelphia.

Mr. G. W. Johnson, treasurer of the Western Electrical Supply Company, of Omaha, Neb., has been in the city for several days visiting the Fair and looking after the business interests of his company.

Mr. Edw. B. Kittle, formerly special agent for the General Electric Company at Portland, Ore., has accepted the position of general sales agent for the Chicago branch of the Waddell-Entz Electric Company.

Mr. Carl K. MacFadden, of Bartholomew, Stow & Co., was married on Thursday, November 2, to Miss Lulu Mae Kimball, daughter of Mr. and Mrs. D. W. Kimball, of Ridgeland, Ill. A number of Chicago friends attended.

Mr. Chas. A Schieren, of Chas. A. Schieren & Company, New York, has received the nomination for mayor of the city of Brooklyn on the republican ticket. His many friends and business acquaintances will unite with us in hoping that he may be elected.

Mr. W. D. Packard, secretary and treasurer of the New York & Ohio Company, Warren, O., has been in the city for several days past doing the Fair and looking after certain business interests. Mr. Packard is very enthusiastic over the new lamps which he has just brought out.

Mr. Geo. O. Fairbanks, who it will be remembered was for a long term of years the manager of the Westinghouse Electric & Manufacturing Co. in Chicago, has connected himself with the Railway Equipment Company, particularly with a view of taking charge of the agency for the Holmes, Booth & Hayden's wire.

BUSINESS NOTES.

The Metropolitan Electric Company, Chicago, has removed its offices from the Manhattan Bldg. to the Monadnock Block where it occupies rooms 521-523.

The Great Western Manufacturing Company, Chicago, owing to its increased business has been compelled to enlarge its offices and store rooms at 201-207 Canal St., which it is now fitting up in nice and convenient shape.

The Pullman Electric Company, 44 S. Jefferson St., Chicago, is making a specialty of rewinding and repairing electrical machinery, as well as the inspection of motors and dynamos. Mr. Wm. C. Pullman has equipped electrically all the cars built by the Pullman Palace Car Co., and is well known to the trade.

The Central Electric Company desires to call particular attention to the Eichburg Patent Tree Insulator, listed in its new general catalogue. This is a new device which it has recently put upon the market, and which is intended to overcome the trouble brought about by the destruction of the insulation on line wire, caused from constant rubbing against branches of trees. The insulator perfectly insulates the line and gives it plenty of play when attached to a branch, permitting it to move in any direction with the swaying of the limb. This device is listed and described fully in its new catalogue.

The Laclede Carbon & Electric Company has recently removed its plant to Kokomo, Ind., where it will continue the manufacture of electric supplies and apparatus, including glass and porcelain insulators, cut-outs, switches, sockets and Laclede and Hercules batteries.

The Empire Electric Company, 171 So. Canal St., Chicago, is the successor to the Illinois Electric Lamp Company. The new company has the same personel as the former one and the object is the same—the manufacture of incandescent lamps for all systems. The factory is in operation and is running full time to fill present orders.

The Reliance Guage Company of Cleveland, Ohio, supplied the safety water columns for the Washington street plant of the Chicago Edison Company. These goods have become recognized as important parts of every first class boiler plant and the awards recently received by this company for its safety alarm water columns and patent solderless floats were but a just appreciation of their worth.

The Electric Appliance Company reports that they are again in the market with Packard lamps and have already filled a number of very large orders. They report that the merits of the Packard lamps are so well appreciated by their customers, that the mere announcement that they are again prepared to furnish them in quantities, causes the orders to shower in in a manner that is extremely pleasing not only from a business point of view, but also from the confidence which is thus evidenced in their leading specialty.

The Great Western Manufacturing Company, Chicago, is at present selling large quantities of the well-known Clark wire, for which it is general western agent. The reputation of this wire is of the best, as it has been on the market for many years. A large stock of it is kept on hand, both at the Chicago and St. Louis offices of the company, and therefore orders can be filled promptly. The company also reports large sales of magnet wire, as well as the H. G. brand of weather-proof wire, of which it carries in stock large quantities. In fact, the Great Western company finds it impossible to keep up with orders promptly. The company reports the sale of no less than three central station plants, besides several isolated plants, during the last week in October. Among recent sales may also be mentioned that to Atchison, Kan., for the entire equipment of both light and railway plants for a consideration of some $225,000.

The National Water Tube Boiler Co. received very flattering results from recent tests of its boilers. The contracts of the several boiler companies with the World's Columbian Exposition, required the evaporation of a given amount of water per hour, based on the usual standard of thirty pounds per horse power per hour. In the official tests made by the Exposition to determine whether or not the guarantee has been reached, the National company's plant has shown an average duty of 41 per cent above the contract. The National boilers are nominally rated at 1,500-horse power, but as rated in the tables of the company are only 1,330-horse power. The equivalent evaporation for several consecutive weeks as shown by the official tests, has been that of over 2,000 horse power, with not the least appearance of forcing. The steam continually furnished is exceptionally dry.

The Consolidated Car Heating Company, Albany, N. Y., at a special meeting of its directors held on Tuesday, October 31st, signed the final papers transferring to an English syndicate the English steam and hot water heating patents of the company. The English electric heating patents have not yet been taken by the English syndicate, although it has an option thereon until January 1, 1894. The option on the heating patents which it bought would have expired November 1st. The total sales of the Consolidated Car Heating Co., including October complete, are slightly in excess of the sales at the same period last year. Within the last week orders for Electric Heaters have been received from twenty-one additional roads, making a total of fifty-one street railways in the United States and Canada, which are using or are about to use the Consolidated Co. Electric Heaters.

Mr. C. R. Huntley of Buffalo, has purchased for the New Lighting Co , at Niagara, N.Y., one of the No. 8 65 light, 2,000 C.P., arc dynamos comprising the service plant of the Brush company in Machinery Hall, to be delivered at the close of the Exposition. This leaves but one of the sixteen dynamos unsold. There will also accompany the dynamos 60 of the double carbon Brush-Adams lamps which are now doing duty on the "all night" circuit at the Fair. The Indianapolis Light & Power Co., have placed an additional order for 100 double carbon lamps which makes 856 which they have bought within eight months. These, taken in conjunction with the 15 65 light dynamos which thay have purchased during the same period shows their apprecation of the Brush system.

The Washburn & Moen Manufacturing Company have just completed an order for railway feeder wires given by the Brooklyn City Railway Company. This order includes 180 miles of 500,000 C. M. stranded weatherproof feed wire, together with about thirty miles of another size. It represented a weight of about 2,000,000 pounds, amounted to about $300,000, and is believed to be the largest single order for insulated wire ever placed in this country. This company had previously furnished the Brooklyn city railway with a quantity of this same style and size of wire, and the recent purchase was the direct result of the high quality of wire furnished by them and the very satisfactory manner in which the business was handled. The Washburn & Moen Manufacturing Company have erected and equipped a large factory devoted exclusively to the manufacture of insulated wires, and are pushing this department of their business in a very energetic manner.

The Chicago Rawhide Manufacturing Company, 75 & 77 Ohio St., Chicago, is to be congratulated upon having worked its factory to its full capacity all the time during the late financial stringency with no reduction in the number of hands. At the present time the factory is exceptionally busy in all departments. Among recent shipments made was a 40-inch main driving belt to John Wanamaker, Philadelphia, which is to be used for operating an electric light plant. Mr. Wanamaker has used the goods of this company's manufacture for the past 10 years, a fact which speaks well for the quality of the product. The company has also recently shipped several other large dynamo belts to various points in this country. Its foreign trade is constantly increasing. Awards of the highest character were given the company on its rawhide belting, lace leather and other products.

The Charles E. Gregory Co., Chicago, is in receipt of the following letter from the Ferris Wheel Co , which speaks well for the apparatus furnished by them.

Chicago, Oct. 14th, 1893.

Charles E. Gregory Co., 47-49 S. Jefferson St., City.

Gentlemen:—We have the pleasure to say that the two 500 light Edison dynamos, which your company furnished us, have given us most excellent service up to the present time, and that we are very much pleased with the installation of these dynamos. We have the pleasure to remain very truly yours,

The Ferris Wheel Co.
Geo. W. F. Ferris, *General Manager.*

The company also reports business excedingly brisk having sold 22 dynamos and motors during October.

The Joseph Dixon Crucible Company, Jersey City, has received awards from the jury of awards at the Columbian Exposition for superior products in graphite, lead pencils, plumbago, crucibles, black-lead stoppers and nozzles, dippers, bowls, foundry facings and lubricating graphite. These awards are a very proper recognition of the qualities of these goods, as the Dixon company is known throughout the world as the pioneer in the graphite industry, and its goods are always considered as the standard. The United States government, in its bids for supplies, says, "Dixon's, or equal."

The transportation lines of Chicago were tested on Chicago Day as no systems of local transit were ever tested before and the companies acquitted themselves in a most satisfactory manner. The Chicago daily papers are the severest critics when the matter of transportation is brought up, but in this case they are all united in their praises for the magnificent manner in which the crowds were handled by the companies. Although each and every company performed their duties to the public in an admirable manner, we believe the cross-town electric lines of the Chicago City Railway are at least entitled to be placed at the head of the entire list. Every possible car and man was placed on this line, and although the equipment is one of the finest in the country, they were utterly unable to meet the requirements of the crowds.

The cars were run as close as it was deemed practical and they were so crowded that every conceivable place was taken up, even so far as the windows and the tops of the cars. These lines moved more passengers per mile of track than any other line, and how they ever ran trains in such a crowd without injuring a person or a breakdown is a mystery. This is without doubt due to the carefulness and thoughtfulness of Supt. Bowen and Chief Engineer Hill in the selection of the equipment and the superintendence of the system.

As in every system of electric traction much depends on the successful operation of the power equipment. The generators and boilers were heavily taxed and the results obtained from the engines were everything that could be desired. These engines are in pair form with cylinders 24 inches in diameter by 48-inch stroke, running 100 revolutions per minute.

These engines, which are of the improved Wheelock type, are equipped with Hill's patented valve system, which system allows the engine to be operated at a greater speed than the regular Corliss practice and also allows one to take steam to full stroke if necessity demands, thus obtaining a greater maximum out of a certain sized cylinder than is the usual practice. Power is transmitted direct to the driven shaft, on each end of which is a Westinghouse generator, by means of the Hoadley system of compound wind rope transmission. The operation of the ropes is absolutely noiseless, and it was interesting to see how easily they performed their heavy duty on that day.

The above engines were manufactured and installed by the California Engineering Company, Hoadley Bros., engineers, who also installed the system of rope transmission. This company have also the exclusive right for manufacturing the improved Greene engine which embodies the latest patents of Mr. N. G. Greene. A 650-horse power tandem compound engine of this type is being installed by this company for the Siemens & Halske Electric Company in this city. The engine is directly connected to the armature shaft. The armature, which is 20 feet in diameter, runs 100 revolutions per minute and acts as a fly wheel.

ELECTRICAL INDUSTRIES.

Vol. IV. CHICAGO. December, 1893. NEW YORK. No. 12.

The Power Plant at the World's Fair.

The engines in the power plant at the World's Fair represented without doubt the types of engines in general use in the central stations and electric power houses in the United States. Thus the power plant was, as it should be, representative of the modern power plant, although on a many times grander scale. In certain directions, size, finish, etc., something has been added, yet the engines were such as one would find in the more recently erected stations. Aside from the engines exhibited in the power plant in Machinery Hall and in the power house of the Intramural Railway but few exhibits were made. The amount of power required, however, was so great as to require a large number of engines which were distributed among the engine builders of the United States thus bringing together a variety of styles and types.

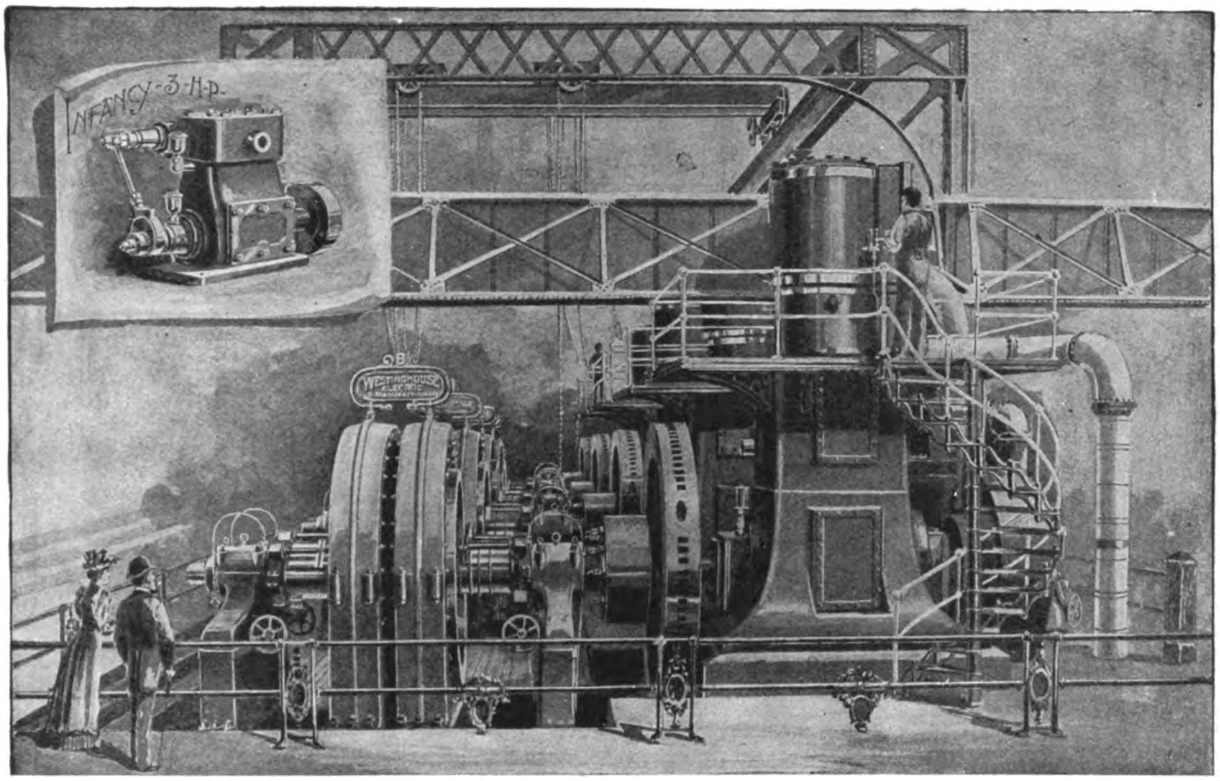


FIG. 1.—THE POWER PLANT AT THE WORLD'S FAIR.—WESTINGHOUSE ENGINES.

It was practically the first great exhibit of its kind, and to persons interested in electric lighting and power it afforded an extensive field for investigation and study. The operation of different systems and different makes of machines, side to side, furnished an excellent opportunity for comparison. The largest individual contribution to the power plant of the World's Columbian Exposition was that of Westinghouse, Church, Kerr & Co., comprising six 1,000-horse power tandem compound condensing engines, each coupled to a 15,000 light dynamo; two 400-horse power single acting compound engines each belted to a 4,000 light dynamo; and three 125-horse power single acting compound engines each direct coupled to a 75 kilowatt generator for exciting the field coils of the alternating current dynamos.

The engraving shows a group of four of the 1,000-horse power engines, and although differing somewhat in appearance from the pattern which has become so familiar as to be instantly recognized, on closer investigation they will be found to embody the distinctive features, which have made the Westinghouse engines successful from a commercial as well as an engineering standpoint. The high pressure cylinders of these engines are 21½ inches in diameter, low pressure cylinders 37 inches diameter, stroke of pistons 22 inches, speed 200 revolution per minute. While nominally rated at 1,000-horse power each, these engines actually indicated over 1,200-horse power and carried this load without laboring or heating.

The governor is in an enclosed case filled with oil, insuring perfect lubrication and consequent freedom of action. The design of the connecting rod is such that by means of a single take up wedge, both crank pin and cross head pin brasses are adjusted equally by one operation. An ingenius device, in the shape of a small cylinder on the side of the crank case, with its piston attached to the valve stem, forms an air cushion for absorbing the inertia of the valve and connections, relieving the governor of much of the strain that would otherwise come on it. By means of a simple arrangement the eccentric rod can be disconnected from the valve stem, and steam can be admitted to the inertia cylinder through a small auxiliary valve, for moving the main valve, independently when warming up the engine prior to starting, or for stopping at any desired point in the stroke.

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but the largest central stations. The largest engine shown stands almost alone as regards capacity, being twice as powerful as the next largest engine.

This engine, which was started May 1st by President Cleveland pressing the button, occupied a central and prominent position on the south side of Machinery Hall. Its rated capacity is 2,500-horse power when working under such conditions as will give the most economical steam consumption; while its maximum capacity is rated at from 3,000 to 4,000 horse power. The engine was exhibited by the E. P. Allis Company of Milwaukee, Wis.

Designed by Mr. Edwin Reynolds of the company, it is quadruple expansion and undoubtedly represents the most advanced ideas in engine construction. After passing through the four cylinders, which are respectively 26, 40, 60 and 70 inches in diameter with a 72 inch stroke, the steam passes to the condenser, below which is Reynold's patent with an air pump 36 inches in diameter and 16 inch stroke. In order to equalize as nearly as possible the two parts of the engine the first and third cylinders are placed on one side and the second and fourth on the other. They are all jacketed on the barrel but not on the head. Below the floor line and between the foundations are placed the vertical cylindrical receivers. The shell of each receiver contains steam at boiler pressure, surrounding brass tubes, through which the steam circulates and is heated on its way from one cylinder to another.

The strength of the engine necessarily required the different parts to be heavy but the skill of the designer has so distributed the metal as to make a symmetrical appearance. The construction of the base of the cylinders combines strength and firmness, enabling the engine to be rigidly fastened to the foundation. The crankshaft body has a diameter of 21 inches; journals, 19 inches and crank bearings 18 inches with a total length of 18 feet. The flywheel is 30 feet in diameter with 72 inch face and weighs 150,000 pounds. The speed is 60 revolutions per minute, which gives it a rim speed of something over a mile a minute. The wheel is composed of 12 segments finely bolted together at the flanges, projecting toward the center and strengthened by the links shrunk on as shown in the outline cut. The arms, which are hollow and eliptical in cross section, are bolted to the rim at the punction of the segments being bolted at right angles to the axis of the arm.

The wheel was put together in the shop and the face and hub turned before being sent to the Exposition, where it was again put together after having been taken apart for shipment.

The regulating gear forms an important feature of this engine; owing to the high rate of expansion it was found desirable to extend the maximum cut-off to eleven twefths of the stroke. By reference to the outline cut the method of regulating the valves will be clearly seen. The supplementary eccentric through the rocker arms gives motion to the lever, which carries at its top a double bell crank which is moved by the governor through a rod connection to the horizontal arms, the vertical arms being connected to the levers upon the detaching gears of the steam valves. This engine has operated two of the large Westinghouse generators of 15,000 lights each. Its total weight is 315 tons.

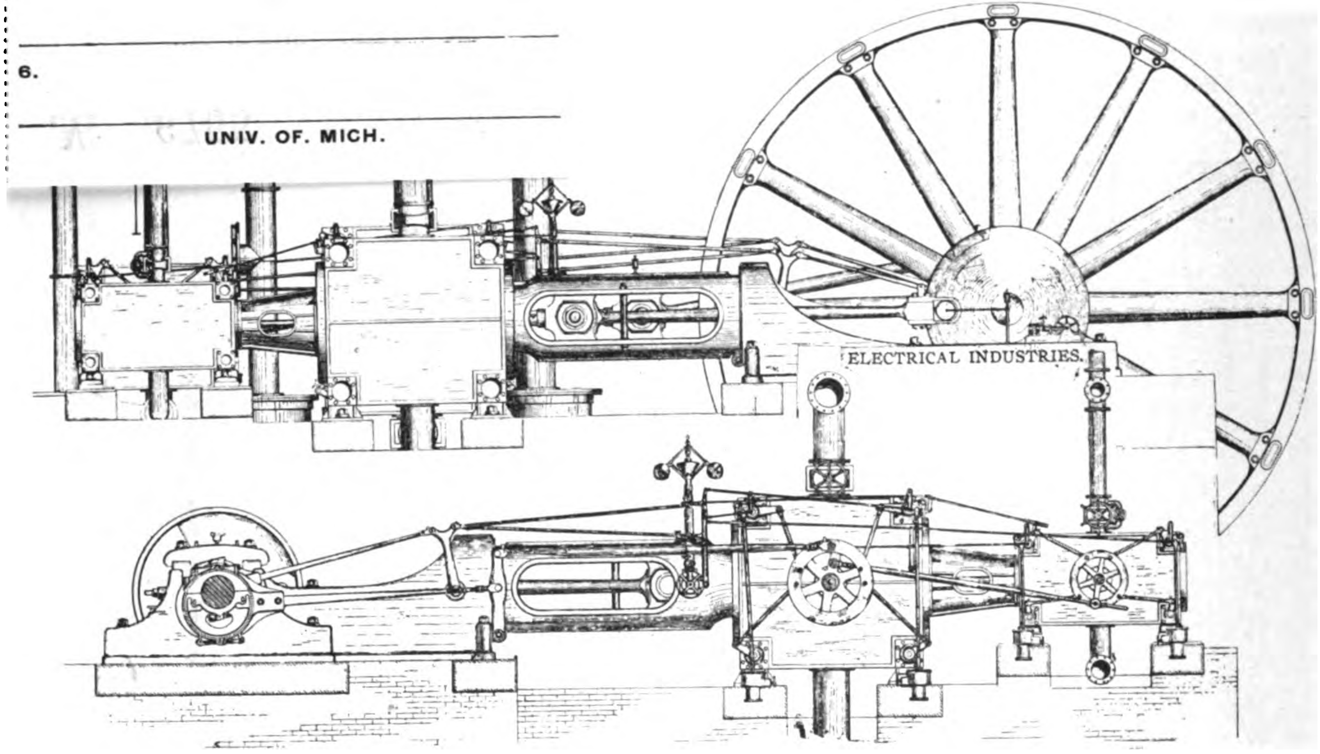


FIG. 2.—POWER PLANT AT THE WORLD'S FAIR.—THE ALLIS ENGINE.

The four-cylinder triple-expansion "Dick & Church" engine manufactured and exhibited by the Phœnix Iron Works Company, of Meadville, Pa., attracted a great deal of attention and favorable comment, owing to the original and creditable design; massive, compact and graceful appearance; and smooth and continuous running.

The engine is of the double tandem type with the high-pressure and one low-pressure cylinder on one side, and the intermediate and second low-pressure cylinder on the other. The high and intermediate-pressure cylinders are attached to the regular or high-pressure bed on their respective sides. The two low-pressure cylinders being attached to a hood carried up from the extension of the sub-beds at the rear of the high and intermediate-pressure cylinders is a decidedly novel and desirable feature. This manner of attaching the cylinders entirely independent of each other, allows each to expand and contract, without any tendency to disturb the alignment of the engine, and without putting any strain on the beds or other parts of the engine or foundation.

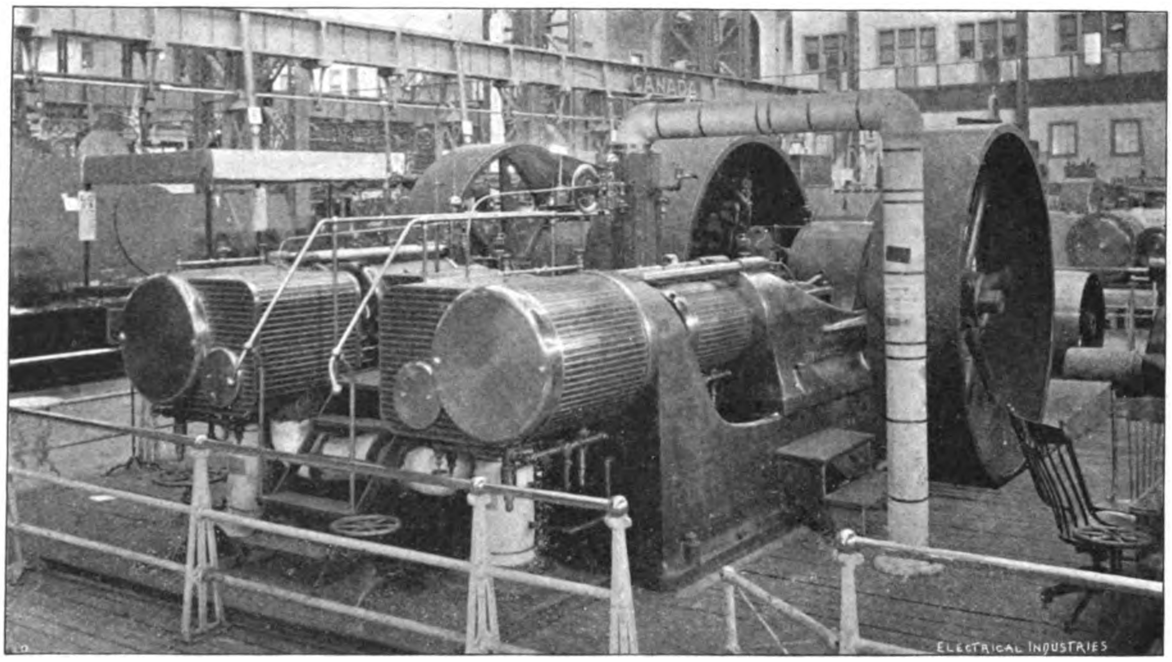


FIG. 3.—POWER PLANT AT THE WORLD'S FAIR—DICK & CHURCH ENGINE.

Although rated at 525-horse power with a maximum capacity of 750-horse power this engine only occupies a floor space of 17 feet 8 inches by 27 feet 7 inches, measured clear of the wheels, and although compactly built, all parts are readily accessible. The diameters of cylinders are high-pressure 15 inches, intermediate 24 inches, and two low-pressure 26 inches, the stroke of all being 18 inches. The working speed is 200 revolutions per minute, and the steam pressure recommended is 130 to 150 pounds.

An intermediate pipe leads from the high-pressure across to the intermediate cylinder. A second pipe leads from the latter cylinder and connects, through a Y branch with both low-pressure cylinders. These pipes are placed as high as practicable to avoid any possibility of a dangerous quantity of water accumulating between cylinders. A notable feature in the design of the engine is that these pipes, which are usually such an obstruction and disfigurement, are in this case put out of view by the steps and raised platform placed between the two sides of the engine to give access to the various parts. The throttle valve, valve gear, cross-head and guides are all readily accessible from this platform, and two oil cups placed on posts of the platform railing deliver oil to all bearings about the engine, including eccentric and all governor bearings. A "starting rig" for turning the engine over by hand, is operated by a lever from the platform. It is therefore obvious that if the engineer was so disposed he could start, operate continuously, or stop the engine without leaving the platform.

The engine is of the center crank type and is provided with three band wheels, two overhung on the outside, and one in the middle. Belts may be carried from either or all three as desired. In this case two Eddy generators were driven, one belted from each outside wheel. When one generator is used it is preferable to belt from the center wheel which has ample face to deliver the full power of the engine. Either or both of the outside wheels are replaced by armatures when it is desired to apply direct-connected generators.

The governor is placed in the intermediate wheel. It is made double, but the two sides are cross-connected so that they are compelled to act together. As the governor controls the valves of all of the cylinders it is obvious that close regulation, and a proper distribution of load, temperature, and initial thrusts between the four cylinders is always assured, throughout the entire range from friction to full load. The valve gear is placed inside, next to the platform where it is readily accessible.

The cylinders, steam chests, cylinder heads and valve covers are all lagged with non-conducting material and encased by exceptionally neat metallic covering, which adds greatly to the general pleasing appearance of the engine. This engine made several long continuous runs, one extending over a period of nineteen days and nights and could have been run for a much longer time had occasion required. The manufacturers claim to obtain better economy from this engine, also their tandem compound, than has previously been obtained from engines of the short stroke high speed type, and inform us that their engines were awarded gold medal and diplomas.

The engine shown in the accompanying engraving was built and installed by McIntosh, Seymour & Co., of Auburn, N. Y. It is of the horizontal double tandem compound condensing type, having high pressure cylinders 18 inches in diameter, low pressure 32 and 36 inch stroke. It runs at a speed of 112 revolutions per minute. A cross section of cylinders and valves is shown in the detail drawings. The cylinders are cast from a special heat of hard close-grained charcoal iron, the guides, pistons and other important parts being cast from the same heat. All joints are ground requiring no packing.

The valves are of the piston type, giving a short length of port and small clearance spaces, and provided with patent valve seats. The valve seat is so constructed that it can be taken up to compensate for its own wear and that of the valve. The seat consists of a ring or rather two rings, made in one piece and connected by several bridges across the port opening which the space between them forms. The seat is crescent-shaped, split and adjustable to fit the valve by the stem which extends to the upper side of the steam chest, where it can be turned by a wrench after removing a cap which covers it.

Each adjustable seat is held steam tight between two permanent seats, but is free to move in the plane of the port, and may be said to ride on the valve. The main valve on the cylinder is in the form of a hollow tube or cylinder with closed ends, and also closed by a partition in the middle steam being admitted to the cylinder from the central spaces, in the interior of the valve through port openings properly situated. There are also ports connecting these interior spaces with the inside of the steam chest and on the outside of the valve in the steam chest a simple sleeve is fitted to act as an auxiliary cut-off valve. The main valve controls the admission of steam, and the opening and closing of the exhaust, and is driven by a fixed eccentric, the cut-off valve being connected to the governor or automatic cut-off regulator.

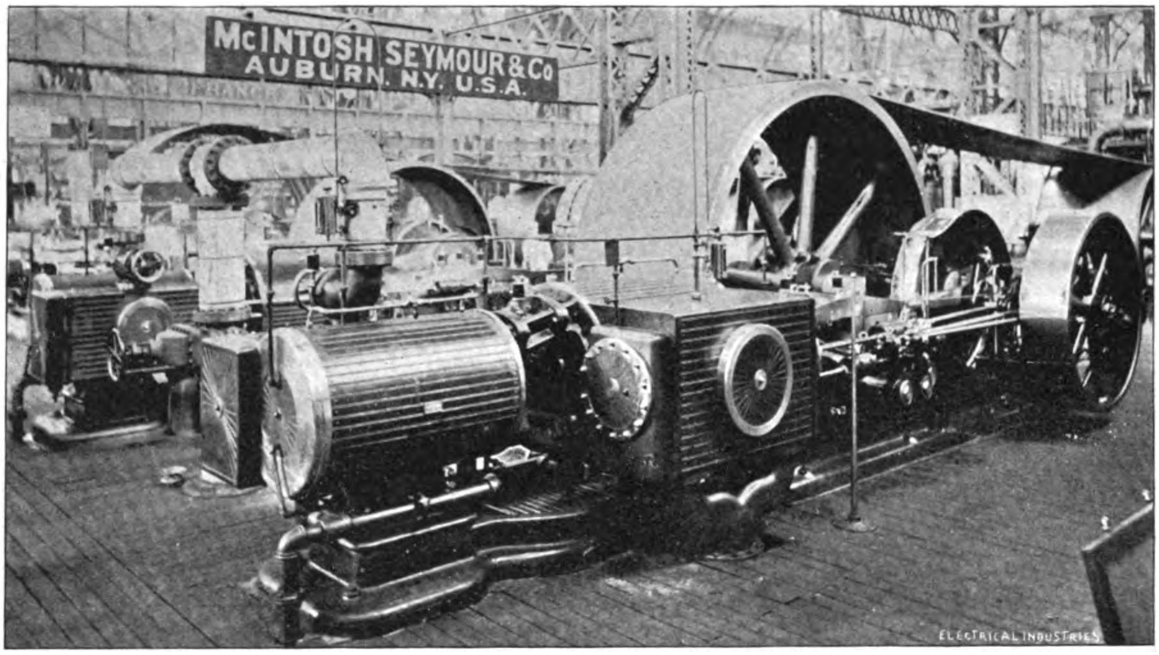


FIG. 4.—POWER PLANT AT THE WORLD'S FAIR.—MC INTOSH & SEYMOUR ENGINE.

Both cylinders are provided with patent relief valves, which can be set to open automatically at any desired pressure, and at the same time can be opened by hand, serving as a drain cock. The high pressure cylinders are provided with steam jackets and the receivers between the cylinders are fitted with copper coils, presenting a large heating surface and rendering the steam perfectly before entering the low-pressure cylinder. This plan has proven itself to be a good one in operation.

The piston rod is of hammered steel, five inches in diameter at the frame end. The cross-head is made of steel, in one piece with the cross-head pin, which is six inches in diameter by nine inches long. It is provided with phosphor bronze slippers and is guided laterally by their inner edges, running against the oil retaining lip on the inner edge of the guides. The crank-shaft is of hammered iron, 14 inches in diameter in the main bearings and 16 inches between. The main bearings are provided with water-jacket shells, lined with babbitt metal. The lower one is machined on the outside, is a true sphere and the frame recessed to correspond, forming a ball and socket bearing. The frame rests upon the foundation for the entire length of the engine, being extended out under and supporting the high pressure cylinder, which is bolted to it but in such a way as to allow the cylinder to expand while hot.

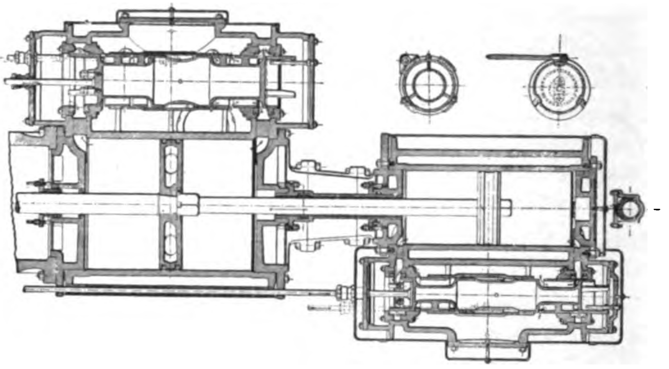


FIG. 5.—MC INTOSH & SEYMOUR ENGINE.—DETAIL OF CYLINDERS AND VALVES.

All valve gear is driven by eccentrics on auxiliary shafts in line with the main shaft and driven from an extension of the crank pin by drag links. The drag-link standard is provided with an inclined rocker arm, connecting with the eccentric strap, the object of this being to neutralize in the valve motion the effect of the angularity of the connecting rod, making the point of cut-off alike in each end of the cylinder for any position of the governor. The cut-off in the low pressure cylinders is varied simultaneously with that in the high, by a sufficient amount to keep the difference in the fall in temperature in each cylinder about constant for all loads, and incidentally divide up the work equally between the two cylinders, thus getting the best possible economy at all loads. In order to effect this, the low-pressure auxiliary valve stroke is much shorter, and to provide equivalent steam opening the cut-off valve is made with two openings on each end, being in fact to some extent a cylindrical gridiron valve. This general lay-out prevents the engine from running up in speed, even though the entire load be suddenly thrown off when running condensing, and a high degree of regularity in speed is obtained.

The governor is of the kind known as shaft governors. Both sides of the engine are operated by the same governor, a cross-over rocking shaft driving the auxiliary valves on the off-side of the engine.

This governor differs from shaft governors designed to drive single valve engines from the fact that it is only necessary to turn the eccentric around on the shaft in order to vary the cut-off, since it drives the auxiliary valves only, whose only function is to control the cut-off. In a single-valve engine, or one in which the valve or valves operated by the governor control the admission and exhaust, as well as the cut-off, it is necessary to swing the eccentric across the shaft and vary the stroke of the valve, making a somewhat more complicated governor, which has to do more work. This firm build both styles of governors, using the latter on smaller engines, and they possess great freedom from friction, due principally to the use of a plate spring opposing the centrifugal force of each weight, by means of a steel pin, hardened, and resting in hardened steel cups at each end. The cup in the weight is situated at the centre of gravity, so that the centrifugal force is directly resisted by the spring in a comparatively frictionless manner. The double spring will tend to keep the tension on the weights equal, in spite of any small inequality in the adjustment of the length of the pins. The two weights are in static equilibrium in all positions. The governor gear is of the best possible workmanship, all pins being made of tool steel, hardened and ground, and the holes they turn in are bushed with hard-phosphor bronze. A good provision is made for thoroughly lubricating all wearing surfaces. The centrifugal weights are so made that they be easily added to or reduced, thus giving a ready means of altering the speed of the engine, should it be needed.

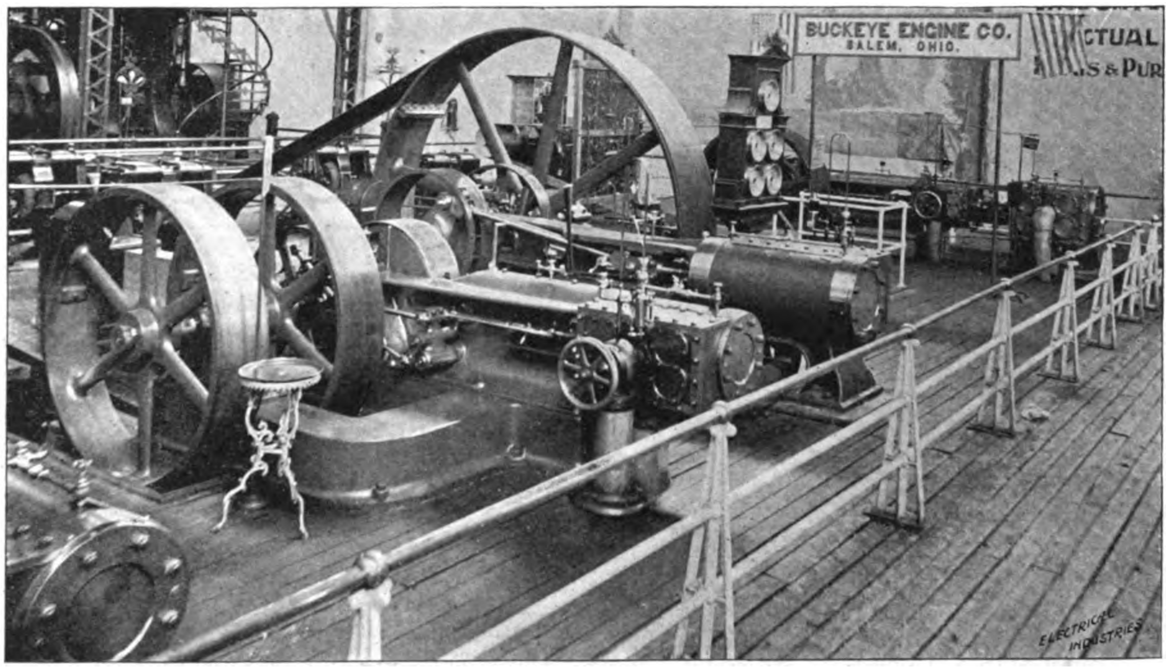


FIG. 6.—POWER PLANT AT THE WORLD'S FAIR.—BUCKEYE ENGINES.

The fly wheel is 16 feet in diameter, by 78 inches broad, and weighs 62,000 pounds. It is cast in four pieces, with two sets of arms; in fact is practically made up of two wheels placed side by side on the shaft and bolted together. Each section is cast separately, planed up, and bolted by reamed bolts, the splits in the rim of each half being placed opposite each other. The wheel is prevented from bursting by 24 two-inch bolts at the rim, and 16 two and five-eighth inch bolts at the hub, not including the bolts used for holding the hub and rim together laterally. The rims are provided in the center and at the edge with broad internal flanges for stiffening the wheel, and preventing oil from getting on the belt.

One of the largest engines in the power plant, excepting the Allis engine, was a four cylinder triple expansion engine built by the Buckeye Engine Co. of Salem, O. It is rated at 1,500 horse power. The high pressure cylinder is 20 inches in diameter and is mounted tandem with a 36 inch low pressure cylinder; while the 32½ inch intermediate with the other 36 inch low pressure cylinder make up the other side. The stroke is 48 inches and the speed is 87 revolutions per minute.

The engine has a 20 foot wheel, 74 inches wide which was belted to one of the 15,000 light Westinghouse alternators. The three large cylinders have the regular Buckeye valves but the high pressure valve is of the piston type. The valve connections of each side extend through to the governor, there being a governor for each side. The values are so constructed that they work easily and without wear; but to obviate excessive resistance in the two heavier valves on the one side, there is upon the valve chest of the intermediate cylinder an auxiliary piston attached to the valve stem and working in a small cylinder to and from which steam is admitted and exhausted by a valve controlled by a lever movement admitting the steam at such intervals as to assist in the movement of the system of valves. This cylinder is four and one-half inches in diameter by five and one-half inch stroke.

There was also installed by the Buckeye company a 350-horse power cross compound engine with cylinders 14½ and 28 by 24 inches, running at 160 revolutions; a high speed tandem compound rated at 175-horse power with cylinders 11 and 12 by 16 inches, running at 240 revolutions per minute; a simple girder engine, 16½ by 30 cylinder, running at 130 revolutions; a 100-horse power engine with cylinder 13 by 21 running at 160 and a 100-horse power high speed engine with cylinder 13 by 60 and running at 240 revolutions. All are of the standard types manufactured by the Buckeye Engine Co. The first of these engines drove six Ft. Wayne arc dynamos, the second a Ft. Wayne power generator, the third four 60 light arc machines, the fourth two similar machines, and the last two of the 60 light arc dynamos.

Several engines were installed by the Watertown Steam Engine Company of Watertown, N. Y. The one shown in the accompanying illustration undoubtedly attracted the most attention. It is a double tandem compound engine. The method of close connecting the two cylinders and of protecting the inside cylinder heads and stuffing boxes from radiation and condensation gives the engine a trim and symmetrical appearance. The engine was used during the Exposition for driving arc dynamos and the engine showed excellent results under the continuous service. The governor shown in the detail cut is attached to the center pulley and operates all four valves by one eccentric rod.

This governor is exceedingly simple in its construction, consisting of but 26 parts including nuts, bolts, etc., and still it governs within one per cent under trying conditions. Its operation is as follows, the letters referring to the letters in the cut: The eccentric A is pivoted upon one of the arms of the pulley at the point B. Sliding within the eccentric is the cam ring C. To the inside of this ring at the point D is pivoted a sleeve fitting upon the engine shaft and having upon its outside rim a pin E. To this pin E is attached the arm and weight F. This weight F is also attached to the arm G swinging upon the pin H. The arm G and the ball F are drawn towards the centre of the shaft by the spring I.

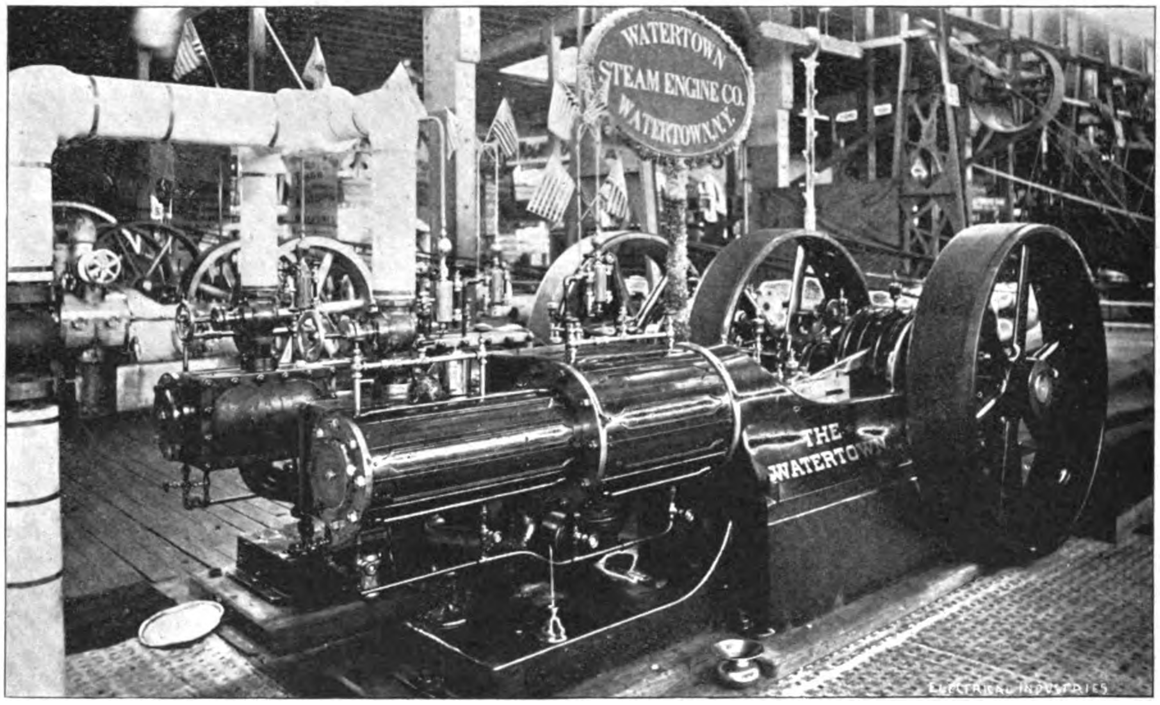


FIG. 7.—POWER PLANT AT THE WORLD'S FAIR.—WATERTOWN ENGINE.

The action of the governor is as follows: The ball F being thrown away from the center by the rapid motion of the wheel pulls upon the pin E and thereby shifts the sleeve and pivot D and the cam ring C, permitting the eccentric to move across the shaft to the right. At the same time the ball K, which is rigidly attached to the eccentric A, being also driven from the center by centrifugal force, shifts the eccentric on the pivot B.

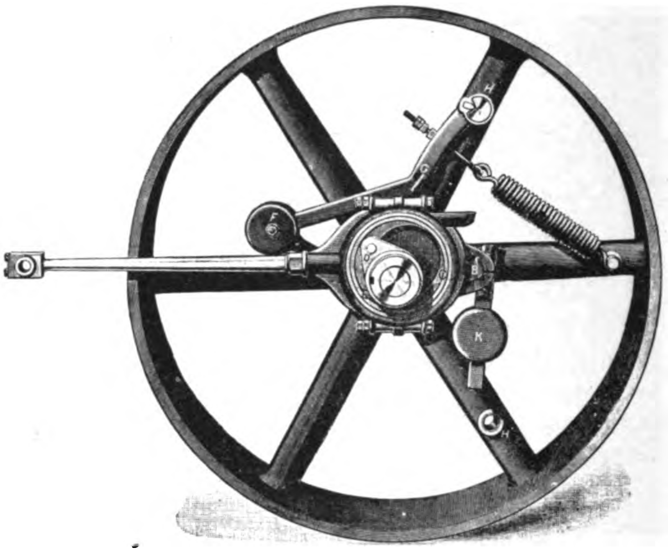


FIG. 8.—WATERTOWN ENGINE.—DETAIL OF GOVERNOR.

Any change in the speed of the flywheel would instantly alter the relative position of this weight K and the wheel. The momentum of the weight K would continue its motion at precisely the same rate of speed as before, and as the speed of the wheel was accelerated or retarded the weight K would at once shift the eccentric by the action of momentum alone. The valves have port openings so arranged as to admit steam to the cylinder ports through four different openings at once. Both valves are connected to the governor thus insuring perfect control. The engine is constructed with broad and substantial base. This company also build simple, cross compound tandem compound and triple expansion engines which are constructed on the same efficient and durable lines as the above.

Two Atlas engines, one a single and the other a double tandem compound engine, were used in the power plant. The single engine drove ten 50-light arc machines; the double one of the Westinghouse 15,000-light alternators. The cylinders of each are the same size, namely 14 and 24 by 30 inches; both are designed to run at 150 revolutions per minute, and are rated at 500 and 1,000-horse power respectively.

They were built by the Atlas Engine Works of Indianapolis, Ind., and while possessing the special features characteristic of these engines several improvements are noted. The massive bed plate, the main bearing with removeable boxes, the peculiar form of cross heads and the automatic dead wheel governor are the same as their standard engines. With the exception of the high pressure cylinder these engines are samples of the single valve automatic heavy duty engine which the company has built for a number of years. To meet the demand for engines of higher efficiency the engines were compounded by adding high pressure cylinders of the Corliss type, having separate steam and exhaust valves for each end. The high and low pressure cylinders are so connected as to permit the removal of both cylinder heads without disturbing the connection. The high speed at which these engines run precluded the use of the regular Corliss valve gear, and the designer of the valve gear succeeded in overcoming the difficulty in a very simple and effective manner. They are like the Corliss except that the valves and seats have a number of ports. This gives them the property of the well-known gridiron valve, large ports, opening with a very moderate motion. The valve seats are sleeves or bushings forced into bored holes in the cylinder and are removable when worn or injured.

The valves have stems and supporting bonnets like in the Corliss arrangement, but instead of the usual catch blocks on the valve stem cranks, the crank pins carry on anti-friction roller bearings, steel cam rollers about two and one-quarter inches in diameter by one and one-half inch face. Instead of the Corliss wrist plate there is a sliding piece supported by brackets on the cylinder between the valve bonnets. The stem of the low pressure valve is prolonged through a stuffing box at the back of the steam chest and connects by means of a drop latch with a wrist on the sliding piece. This gives the sliding piece when the engine is running a reciprocating motion variable in extent with the throw of the eccentric of the shaft governor. This governor controls the engine by changing the throw and angular advance of the eccentric, but is so arranged that the action of the weights and springs is reinforced by the inertia of a heavy loose wheel, which gives it unusual power.

On the sliding piece is mounted a set of cams which engage the rollers of the valve cranks and operate the valves. The motion of the cam slide is such that at the end of a stroke of the pisten, the cam roller is just at the top of the incline of the cam groove. While the engine is passing the center, the cam slide moves far enough to carry the roller down the incline and opens the valve. When cutting off at the shortest point, the cam slide moves no further than to give the valve its full opening, when the eccentric passes its center and reverses the motion of the slide, immediately closing the valve. When the load requires a longer admission of steam, the governor increases the throw of the eccentric and the cam roll passes beyond the incline of the cam and runs upon the lower level, holding the valve side open until, by the return motion of the slide, the incline is again reached, which shuts the valve and cuts off the steam. The roller then runs upon the upper level, holding the valve shut until the end of the return stroke of the piston. The exhaust valve cranks are double armed. One arm of each carries a cam roller and the other two are connected by a parallel rod, which compels the pair of valves to move together. The opening of one valve shuts the other.

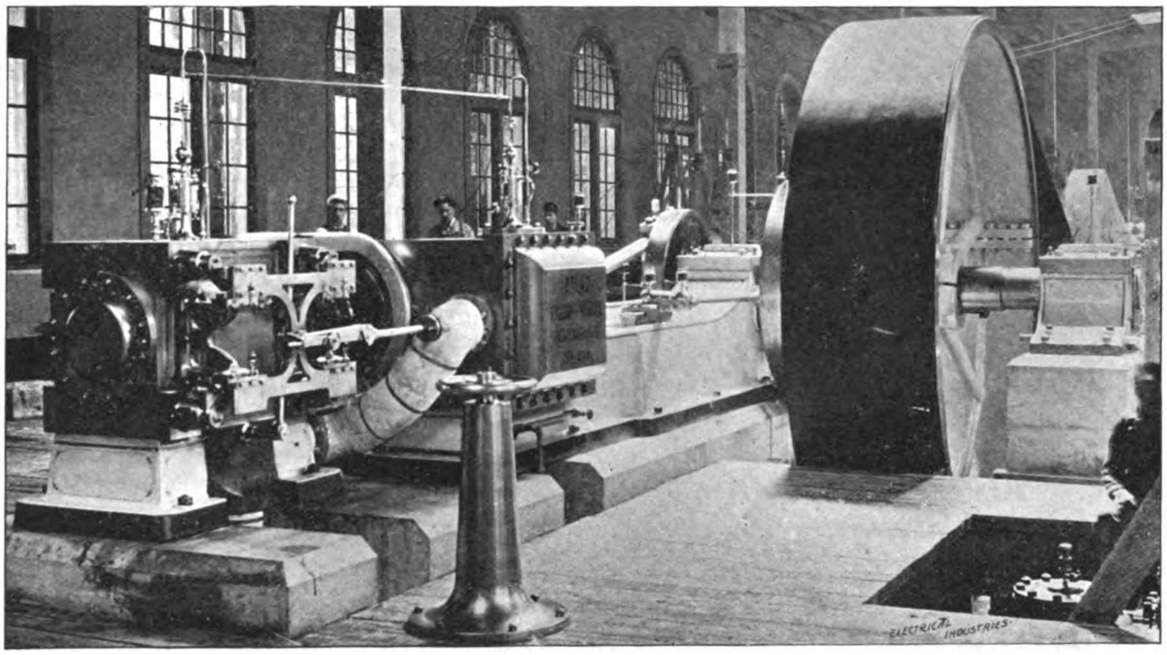


FIG. 9.—POWER PLANT AT THE WORLD'S FAIR.—ATLAS ENGINE.

The indicator card taken from one of these engines shows the distribution of steam to be nearly perfect. By means of the drop-latch the cam slide may be disconnected from the eccentric. A starting bar is provided by means of which the valves may be worked by hand to back the engine off the center in starting. The whole arrangement is neat in appearance, noiseless in action, effective and durable.

For running the Brush arc machines in the power plant the Ball & Wood Company installed a number of engines representative of the different styles of engines it manufactures. These engines demonstrated in a practical manner their fitness for driving electrical machines. Of the five engines, two were simple engines, two were tandem compound and one cross compound. The general style of the engines, which are of the Ball improved automatic cut-off type, is shown in the accompanying illustration.

The perfection of the details of the engines is evidence of the mechanical skill employed in their construction. They present a symmetrical and compact appearance, an important feature, especially in power houses of limited floor space. Close regulation is shown in their operation, due to the excellence of the governing device, in which, by the use of both dash pot and spring, great sensitiveness is secured. By referring to the accompanying cut the construction is clearly shown.

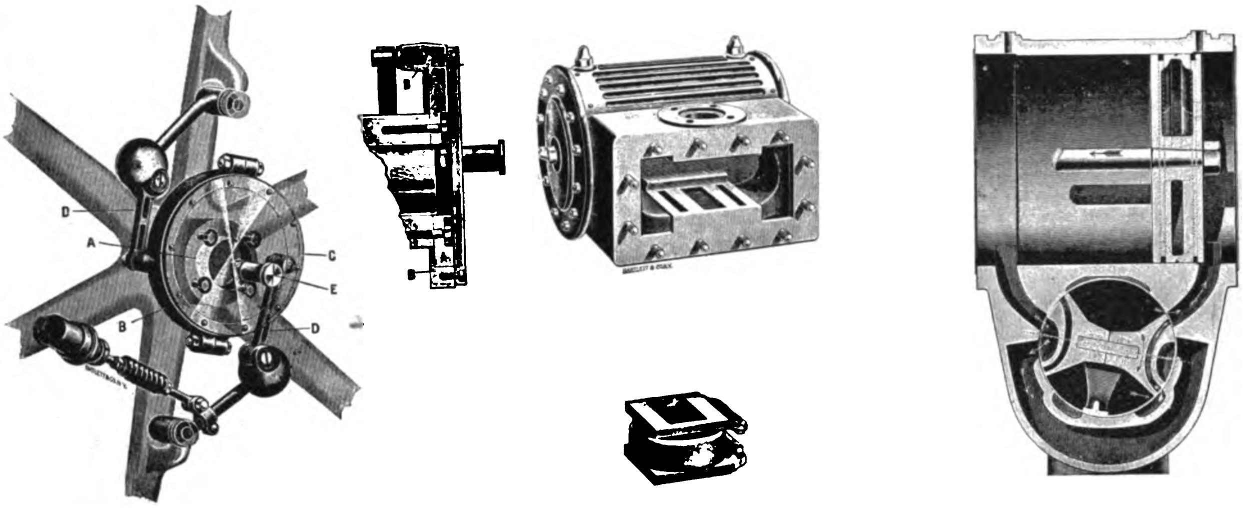


FIG. 10.—POWER PLANT AT THE WORLD'S FAIR.—DETAIL OF VALVES AND GOVERNOR OF BALL & WOOD ENGINE.

The weights are connected by links to studs in the side of the eccentric strap so that the strap and plate, c, are turned slightly around by the radial movement of the weights. The radial movement of the weights is thus made to turn the plate, c, around its center which is eccentric to the shaft and therefore the crank pin, E, is moved through the arc of a circle, whose center is the center of the plate, and by this movement the various points of the cut-off are obtained. The device is very simple with but few moving parts. The crank pin is really the only wearing part as it is the only one in constant motion. Thus there are but few parts to oil and but few parts that can get out of order.

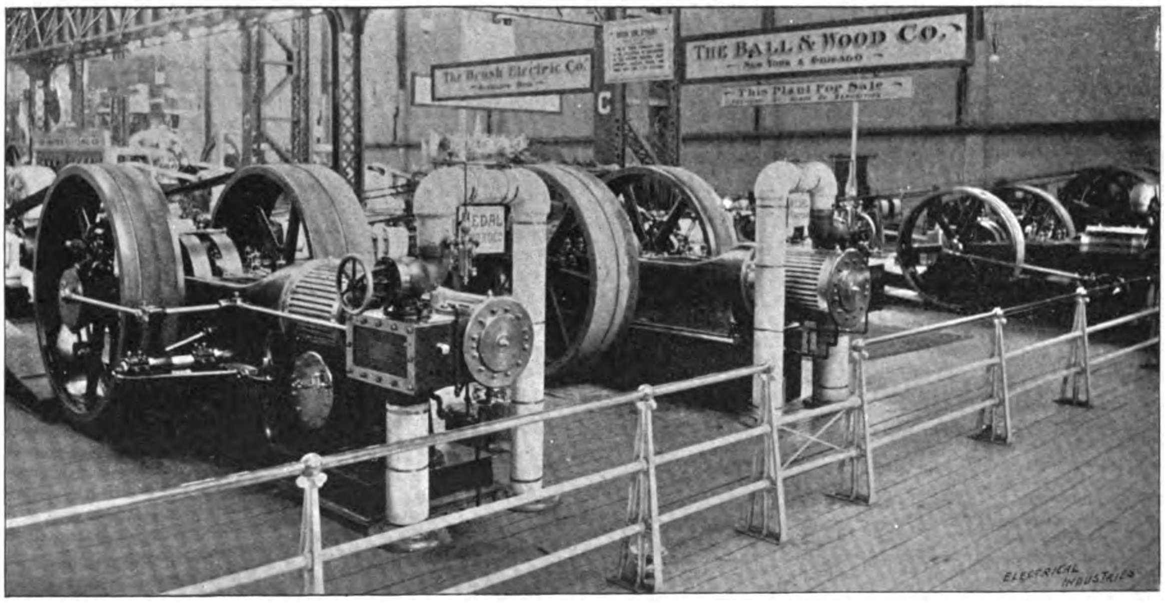


FIG. 11.—POWER PLANT AT THE WORLD'S FAIR.—BALL & WOOD ENGINES.

The valves form another important and interesting feature of these engines. The general construction of these valves is shown in the detail cuts. The light pressure valve is made in two parts, having its faces opposite and with telescopic sleeves connecting the two parts and allowing each face to be pressed against its corresponding seat in the steam chest. Steam is admitted to the interior of the sleeves and thence through the ports into the cylinder. The valve chest of the low pressure cylinder is placed beneath the cylinder and transversely to the axis of the cylinder. Two double ported valves with arc shaped facer fitting the bore of valve chest are placed opposite each other and mounted loosely on a central valve stem which drives them both and allows both to be held in contact with their facer by steam pressure. Steam is admitted from the valve chest end on edge of the valve and also through the port in valve, giving a wide opening. At the same time the exhaust has a very direct passage to the atmosphere in the condenser.

All parts of the engines are made from standard patterns and duplicate parts are kept in stock so that should it be necessary to replace any part the time required would be only that consumed in shipment.

Russell & Co. of Massillon, O., exhibited both simple and compound engines. For driving the arc dynamos of the Standard Electric Co., a double and a single tandem compound engine were used as shown in the accompanying engraving. The former is a four valve engine with cylinders 15 and 24 by 24 inches and runs at 125 revolutions per minute. The position of the cylinders is the opposite of that of many tandem compound engines, the high pressure cylinder being placed in front of the low.

The admission and cut-off valves are triple ported, balanced slide valves, balancing being effected by admitting steam between the valve faces, leaving narrow strips or bridges for the valves to ride on. Actual contact of surfaces is prevented, and the valves are really carried between layers of steam, making their movement a very easy one. The cut-off valves slide on the backs of the main valves, and are operated by a separate eccentric which is connected to the governor in such a manner as to cut-off proportionately to the load.

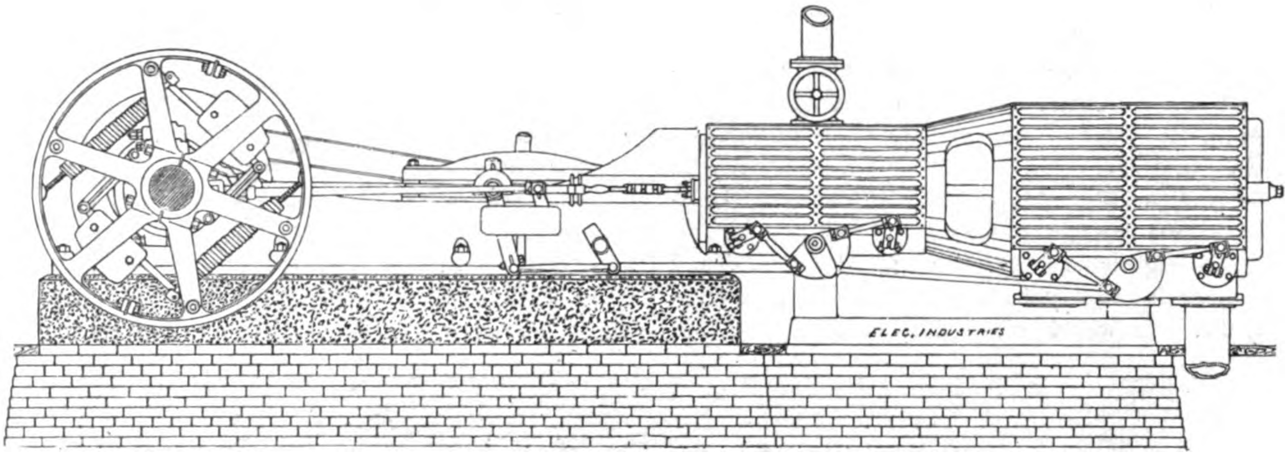


FIG. 12.—POWER PLANT AT THE WORLD'S FAIR.—DETAIL OF RUSSELL ENGINE

The extreme range of cut-off extends from nothing to ¾ of the stroke. The cut-off eccentric, as usual in governing arrangements of this kind, fits loosely on the engine shaft and is connected with the weight arms in such a manner that it is moved around the engine shaft either forward or backward as the weights change their position, thereby cutting the steam off earlier or later in the stroke as the governor, or more properly the weights, adjust themselves to the load. When the cut-off eccentric is rotated forward, that is, around the shaft in the direction the engine runs, the steam is cut off earlier in the stroke; when the eccentric is rotated backwards the steam is cut off later in the stroke.

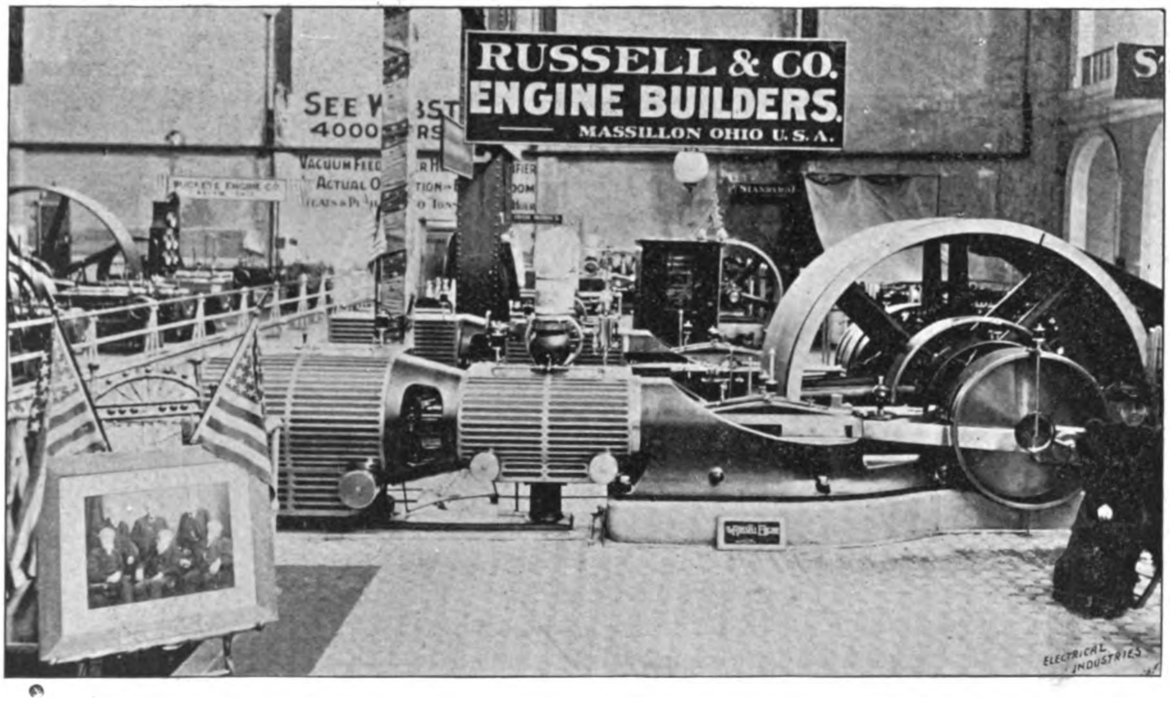


FIG. 13.—POWER PLANT AT THE WORLD'S FAIR.—RUSSELL ENGINES.

The exhaust valves are cylindical in shape and are operated through the wrist plates by the same eccentric that works the main steam valves, but their connection to the wrist plate is such as to insure a "dwell" at the time of steam admission and a correspondingly rapid motion at the time of release. This makes the maximum travel of the exhaust valves occur at a time when the pressure upon them is very small and insures smooth working. The whole valve gear it will be understood is designed so that the cut-off valves of both high and low pressure cylinders, are under the control of the governor.

The balance wheel of this engine is 10 feet in diameter with 60 inch face and weighs 18 tons while the total shipping weight of the engine is 89,172 pounds. The engine is rated at 600-horse power with a water consumption is said to be 14½ pounds per horse power per hour when running condensing. The second engine is of Russell & Co's. single valve type, with cylinders 13 and 20⅛ by 20 inches. Its speed is 180 turns per minute. This engine will develop 200-horse power on a claimed water consumption, as shown by the indicator, of 18 pounds when running condensing and 22 pounds when operating non-condensing.

In addition to these engines there are two simple 17x24 inch, four valve automatic engines, running at 150 turns per minute, essentialy the same, so far as valve details are concerned, as the four valve double compound engine already described. Each of these engines will develop

200-horse power with claimed water consumption as in the preceding case, of 18 and 22 pounds power per horse power per hour when running condensing and non-condensing respectively. A fifth engine, exhibited by the same builders is a simple 13x18 inch, single valve automatic engine running at 235 turns per minute and designed for an economic load of 100-horse power. The water consumption claimed for the engine being 22 pounds per horse power per hour when condensing, and 26 pounds when non-condensing. The valve of this engine takes steam from underneath and is held to its seat by enough steam being admitted into the chest to accomplish this purpose without overloading it. The steam is admitted to the cylinder through "carry over" double ports and the exhaust is accomplished through a " D" passage.

Among the engines specially designed for heavy work and continuous service was one installed by the Ball Engine Co. of Erie, Pa. It was a cross compound engine with cylinders 18 and 36 by 18 inch stroke and designed for a speed of 200 or more revolutions per minute with a steam pressure from 110 to 120 pounds. Under these conditions the engine will develop economically 500-horse power.

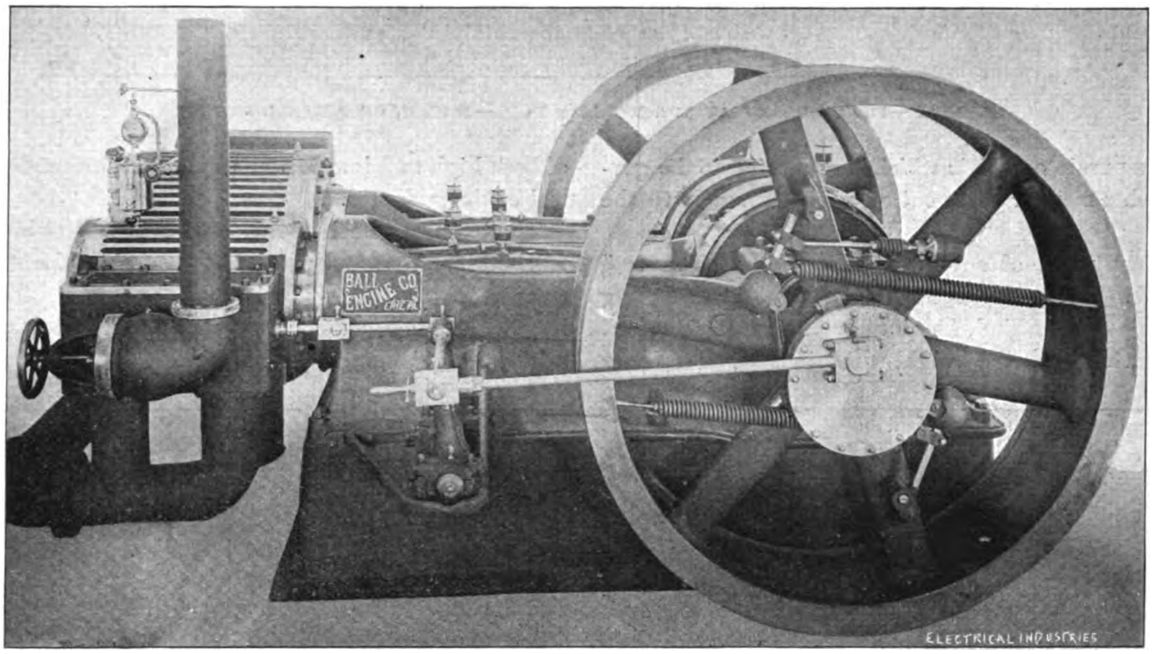


FIG. 14.—POWER PLANT AT THE WORLD'S FAIR.—BALL ENGINE.

It is substantially built with every part indicating strength. The cranks are placed opposite, making the engine well balanced and capable of high speed without vibration. In the accompanying cut the general design of the engine is shown. The governor has two weights and two counteracting springs in addition to which there is a third spring, attached at one end to the weight arm and at the other to the piston rod of a dash pot. This dash pot is made up of a simple cylinder filled with oil, and having a piston with an aperture through which the oil passes as the piston is moved back and forth. This dash pot forms a yielding base for the spring. When motion of the governor weights takes place, this supplemental spring is put under tension for the moment and gives stability to the governor, but the dash pot quickly releases the tension and the spring returns to its normal condition. The speed is determined by the long springs which may be regulated so as to give a range of cut off up to ⅝ stroke.

The high pressure cylinder value consists of two parts, connected in telescopic fashion allowing each part to adjust itself to its seat. The port openings are of good size and give a liberal admission of steam up to nearly the closing point. The same is true of the discharge of steam from the cylinder into the chest. This valve is directly controlled by the governor. The low pressure valve is driven independently by an eccentric, which is not influenced by the governor. It can be adjusted by hand to suit the conditions of load. It is a plain slide valve, provided with relief area rings on the back. While giving large openings for the admission of steam they work easily and with little expenditure of power.

The crankshaft is made of one solid piece of steel, machined off and key seated to receive the counterbalance weights. These are slipped on the shaft and after being keyed up solid are turned off and polished.

Another tandem compound engine was installed by the J. H. McEwen Mfg. Co. of Ridgeway, Pa. The engine was of their standard style of compound engines with a high pressure cylinder 12 inches, low pressure 20 inches and an 18 inch stroke. The high pressure cylinder is fitted with the company's balanced valve and the low pressure partially balanced valve.

The governor which controls the speed of the engine and which is guaranteed to maintain that speed under all conditions of load, is very simple in construction. The change of speed is effected by changing the tension of the spring or by adding or taking shot from the centrifugal weight. The governor does not require lubrication and so is not injured by want of attention. It is known as the inertia governor, being dependant on the inertia of the weight for its regulation. Its simplicity, few parts and durability are some of its important mechanical features; while its close regulation, the quickness with which it acts, causes it to fulfill its function to a fine degree of exactness.

In the construction of engine valves the company has long held a high position. Realizing the important parts the valves play in the perfect operation of an engine special attention was given to the construction of the valves. The alignment was carefully looked after and by special construction the extra friction caused by the steam pressure was removed so that the only wear is due to the weight of the valves themselves. The builders have not followed the lines accepted by many builders of building a light engine for light work and a heavy one for heavy work but build a strong substantial engine which will be able to stand any excessive load.

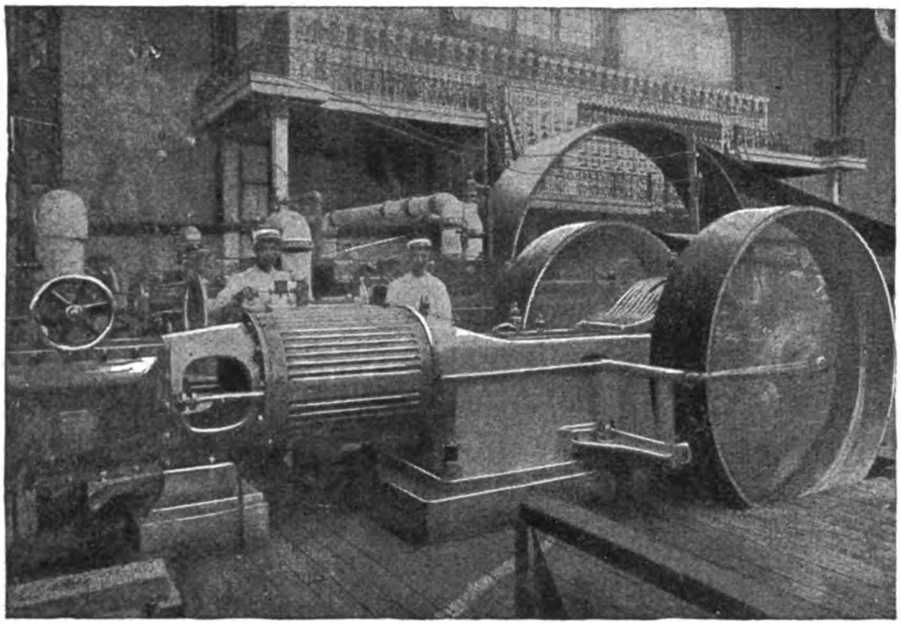


FIG. 15.—POWER PLANT AT THE WORLD'S FAIR.—MC EWEN ENGINES.

Two Woodbury tandem compound high speed engines were installed by the Stearns Mfg. Co., of Erie, Pa. The smaller runs at 200 revolutions per minute and has an indicated horse power when run at most economical point of 375. The cylinders are 15 and 25 inches with a 20-inch stroke. The driving and governor pulleys are each 88 inches in diameter with a 23 inch face.

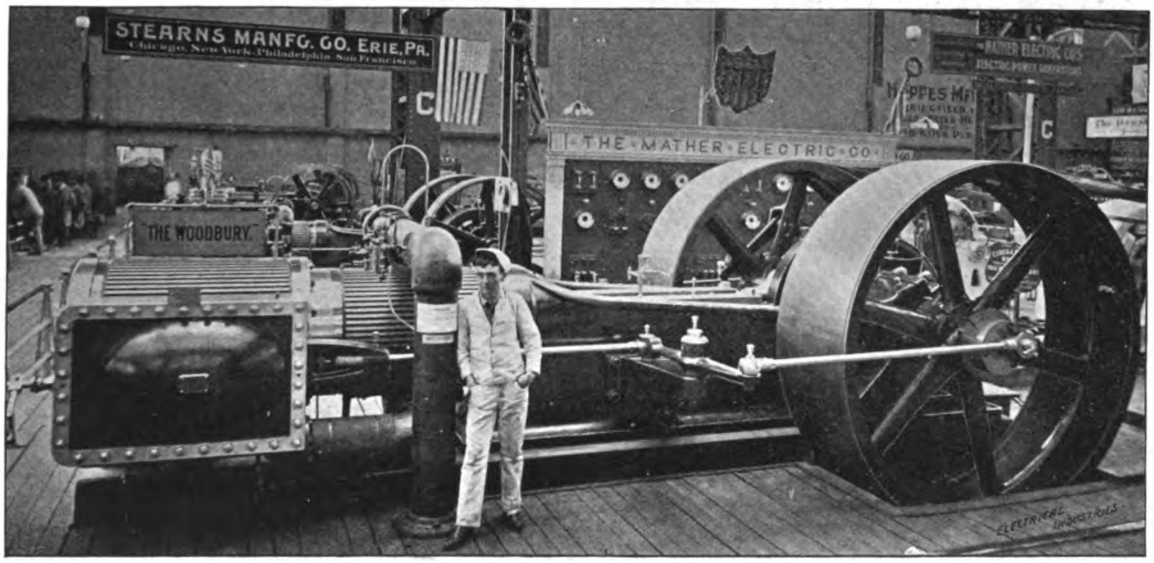


FIG. 16.—POWER PLANT AT THE WORLD'S FAIR —WOODBURY ENGINES.

The other engine which is of a like design and when operated most economically has a capacity of 600-horse power but will carry a load of 800-horse power. The cylinders are 19 and 31 inches in diameter with a 24-inch stroke. The speed of the engines is 165 revolutions per minute. The pulleys are 102 inches in diameter with a 31-inch face. The valve of the high pressure cylinder is of special construction. The design is very ingenious and has given perfect satisfaction in operation. The steam is admitted through four ports at the same time. The exhaust passes through two openings which give a large area and consequent quick exhaust.

The low pressure valve is the same as the high pressure except that it is not provided with two supplemental ports. The governor controls both valves. The governor is made up of weights and springs with no eccentric. There is a bob on the outside which is moved by the weights but the centrifugal force is counteracted by the spring. The crank shafts are solid steel forgings. The high pressure cylinder is placed next to the frame and all moving parts are so arranged as to be passed through the low pressure cylinder if it is desired to take the engine apart. The engines were operated continuously for driving electric generators and showed good results. The neat appearance and careful finish of the details of the engines attracted considerable attention.

Several engines especially adapted for power station service were installed by the Lane & Bodley company, of Cincinnati, O. Of these one was a simple engine, one a tandem compound and the other a cross compound. The simple engine has a cylinder 18-inches in diameter and a 42-inch stroke. It is finely designed and capable of hard service. The governor is of the Hartnell pattern and as extended experience has shown is durable and close regulating.

The tandem Corliss engine is of the company's standard pattern. The high pressure cylinder is 16-inches in diameter, low pressure 29 inches and stroke 42-inches. The frame is of a heavy girder type. The mean bearing of the shaft is 10 15-16 inches in diameter. The low pressure cylinder is placed next to the girder and the connection between the two cylinders is of a very neat and substantial design. The receiver is placed beneath the floor. The cross compound engine is the latest engine designed by the company. The girder is of box section and with the main box and slide support is in one casting. The sides are bored to a large radius giving a very large wearing surface for the crosshead on the slides. The cylinders are made without the usual square corners but are of a very neat and symmetrical design. The steam chambers are large and the valves are well made with sufficiently large openings to give easy access to the steam and a quick exhaust. The steam pipe is five inches in diameter and the exhaust to the condensers is ten inches in diameter. The cylinders are 16 and 31 by 42 inches. The large fly wheel of the tandem compound engine is belted to shafting beneath the floor from which the different arc dynamos were connected. The engines as a whole show skill in the designs and excellent workmanship in their mechanical construction. The accompanying engraving shows an engine installed by the Erie City Iron Works. It was used to operate four of the Standard Electric Co's. 50 light arc dynamos. It is rated at 200-horse power and runs at 275 revolutions per minute. Two dynamos were belted tandem from each wheel. The general design of the engine is shown in the accompanying cut. The governor is of the Webber automatic pattern. The engine is compactly built and occupies but little space in proportion to its capacity. The fittings are of the latest improved pattern, sight feed oil cups, Detroit lubricator, etc.

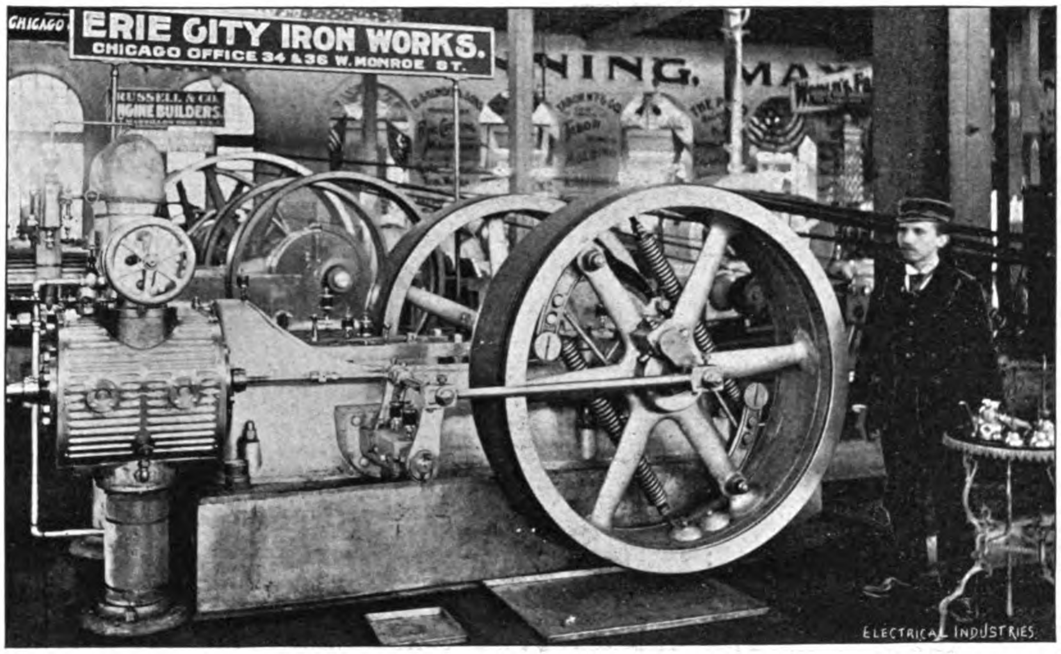

CHICAGO
ERIE CITY IRON WORKS.
CHICAGO OFFICE 34 & 36 W. MONROE ST.
RUSSELL & CO. ENGINE BUILDERS
ELECTRICAL INDUSTRIES

FIG. 17.—POWER PLANT AT THE WORLD'S FAIR.—ERIE CITY ENGINES.

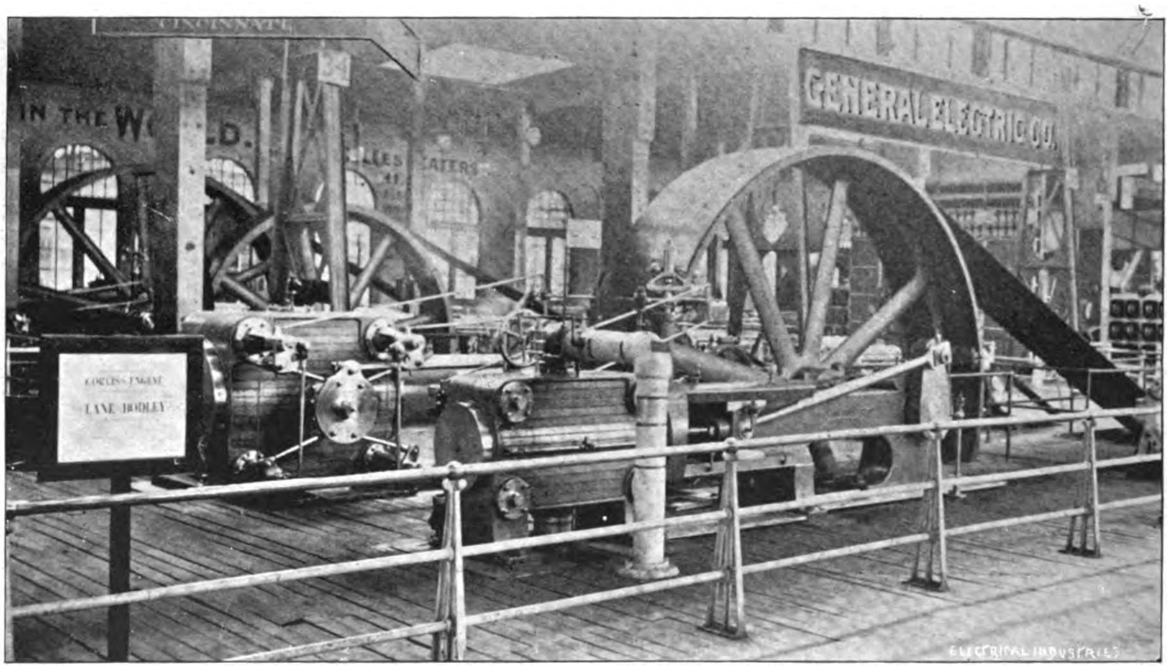


FIG. 18.—POWER PLANT AT THE WORLD'S FAIR.—LANE & BODLEY ENGINE.

Another vertical engine direct connected to dynamo was shown at the east end of the power plant. Although not as large as the other vertical engines shown, it represented a size adapted for many stations and especially for isolated plants. It was a 100-horse power Willans engine, manufactured by M. C. Bullock & Co., of Chicago, directly connected to a General Electric generator. It is of the same style as the larger sizes in which these engines are made, and represents a type of engine largely used in electric stations in Europe.

The engine is a central valve engine. The valves, which are of the piston type, work inside the piston rod and give an excellent distribution of steam and good drainage for water. The high speed at which they are operated gives an efficient and economical operation especially adapted for electric generation.

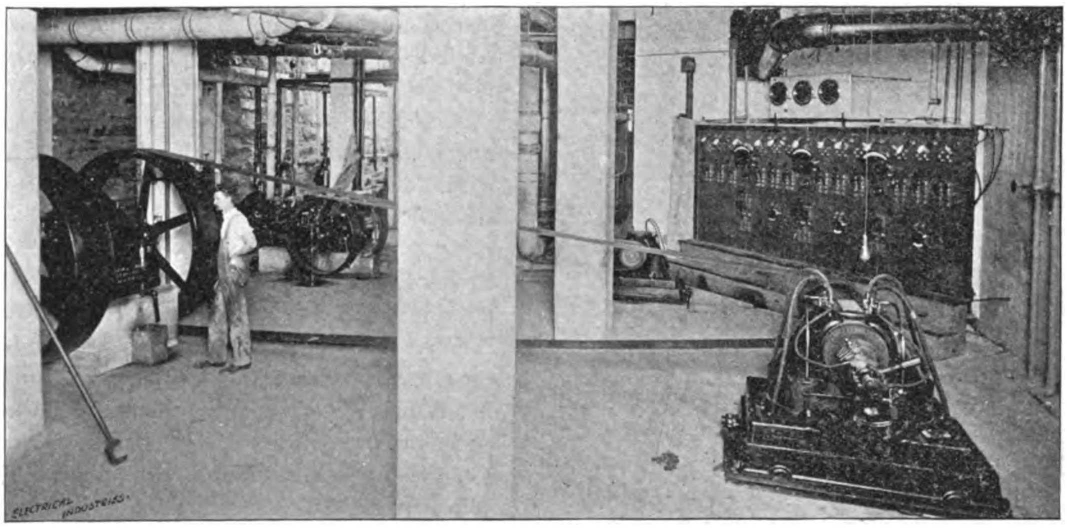
Equitable Building Lighting Plant, Denver.

One of the handsomest office buildings of Denver is the recently erected Equitable Building, situated at the corner of 17th and Stout streets, near the center of the business part of the city. It is built of granite, golden pressed brick and white terra cotta. The granite is confined to the two lower stories. The architecture is of the Italian Renaissance style and the building has been built and equipped in a most thorough manner.

Incandescent lights are used throughout the entire building and in the selection of the equipment the architects have maintained the same standard of excellence. The accompanying engraving shows a view of the plant located in the basement of the building. Three continuous current dynamos of the latest pattern, manufactured by the Western Electric Company, two of 800 lights and one of 460 lights capacity, furnish the current for the building. The machines are compound wound, practically self-regulating and are fitted with self-oiling bearings. The amatures are almost indestructible as they are built up of copper rods laid in channels of fibre around the armature. The commutators are substantial and well insulated with mica, so that the only danger of a burn out is from an excessive overload, there being no resinous insulation to melt or become brittle from continual heat. The dynamos are carefully and durably constructed throughout. The people of Denver have appreciated the merits of these dynamos and there are already installed in and about Denver 15,000 lights capacity.

The switch board is of Tennessee marble finely finished with handsome trimmings and instruments which are also of Western Electric manufacture, being made from special drawings. On this board are mounted all the instruments, switches and controlling devices necessary for the operation of the plant. The rheostats are mounted on the back of the board and are operated by small hand wheels from the front. The switches are all double pole and have a durable appearance and extra finish. The board is so placed that it can be seen from any part of the engine room.

The mains start from the switch board and are carried up the pipe shaft to the floors where they terminate. The wiring was done with special reference to the needs of an office building. As few wires were run on the cross partitions as possible and the whole arranged so that these partitions can be moved without interfering with the other lights. Interior conduit was largely used, which together with the special mouldings protect the wire from the plaster. An ingenious arrangement for securing extra lights in an office is worthy of mention. A small moulding runs around the walls of the offices, two inches from the ceiling. The upper part of the moulding is similar to picture moulding but in the recess back of the rounded upper edge are two grooves in which two wires encircle the room. By the use of a special bracket, consisting of a tube about 18 inches long, fastened to a plate which hooks over the top of the moulding, these wires may be tapped at any point and a cord brought out through the bracket and dropped down over a desk. The system is such that it is easily changed to suit the wants of the tenants.



EQUITABLE LIGHTING PLANT, DENVER.

The entire work was installed by the Mountain Electric Co., of 17th and Glenarm Sts., Denver, which had the contract for the entire work from the foundation to the lamp. This company has an established reputation for electrical work in the west and a large number of isolated and central stations throughout the state have been installed by it. The company is the Denver agent of the Western Electric Co.

The Illinois Central Railway is offering great inducements for urban and suburban traffic. The fare has been reduced from 50 to 75 per cent, and the service in many ways improved. The electric roads which cover the district south as far as Pullman are also making efforts to encourage travel over their lines.

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CORRESPONDENCE, opinions and data bearing upon the practical application of electricity in any of its branches are earnestly desired and will be heartily appreciated.

ADVERTISING RATES upon application.

ALTHOUGH the improvement of the industrial condition has been slow it is sufficient to be noticeable. The orders received at the factories cause a more hopeful feeling and many expect soon to be in full operation. Collections for the past month are reported better than was feared. An increased demand for supplies has made the trade of the supply houses better than for several months. The number of new plants projected and improvements contemplated indicates a brighter future for the electrical industry.

THE interest in the secondary or storage battery has been revived during the past year. The introduction of several new forms of cells, their practical adoption in connection with the transmission and utilization of electric power and a number of papers on the subject, read before technical societies, have each helped to bring the subject to public attention. Their economy in central stations by storing the surplus energy when the station is called upon for light loads and giving it up when a large load is demanded, has been demonstrated by a number of such installations. The operation of the cars on Second ave., New York, by secondary batteries built by the Waddell-Entz company and the reports made public regarding the cost of operation have awakened a new interest in storage battery cars. The cost of operation per car mile as shown from the cost of operating the six cars is much larger than by the trolley system; but it is estimated that if 18 cars be run the cost of labor would be greatly reduced per car and would bring the cost per car mile nearer that of the trolley. On the storage battery line the cost of constructing the overhead system and of constructing a return circuit is absent with the cost of maintenance. On long lines with cars at ten minute intervals this cost, it is estimated, would bring the expense for the overhead trolley system above that of the storage battery. Possibly with more information and experience the storage battery car will yet become a sharp rival of the trolley.

THE construction and operation in Chicago of two lines of elevated road and the projection of several others has aroused the street railway companies to the necessity of improving their systems of surface transportation. They must either improve their lines or suffer from the competition of the elevated roads. With this in view several applications are before the city council asking for permission to use the trolley system of electric propulsion. The north and west side street railways have made an application to the city council to modify the clause in the ordinance passed in 1892 which reads: "In the event of electric power being used, the same shall be placed under ground and its method of construction shall first be approved by the Commissioner of Public Works." The companies desire to have this clause modified so as to allow them to use the overhead trolley. The Chicago City Railway has also petitioned the city council to allow it to use the trolley system on the lines now operated by horses. No sooner had these applications been made than the daily papers commenced an attack on the overhead trolley system using arguments which would be hardly a credit to a school boy ten years ago, when the public was impressed with the power of the electric current but knew little of its value as controlled by man. In and about Chicago there are over one hundred and fifty miles of electric street railway which during the past summer and fall carried crowds that covered the outside as well as the inside of the cars. In fact in the neighborhood of Jackson Park morning and evening the cars carried all that could find a place to hang on. The accidents were remarkably few and caused in the majority of cases by the person's own carelessness. The total number of persons injured during the Fair has been more than equalled by a one week's record of the cable roads. It has proven as safe as any form of surface rapid transit if not safer, and the record made during the summer should be sufficient to convince the most prejudiced of the worth of the system. A well authenticated case where the current from the trolley has directly caused death has yet to be recorded. While the testimony of hundreds of workmen who have received a shock from the lines, although not acknowledging the pleasure of the sensation, would indicate that it was not fatal except to persons of feeble constitution. The accounts of the daily papers of accidents are in many cases very amusing. Not very long ago a dog lay down on the track and failed to get up before the car reached it. The morning paper appeared the next morning with "Another Death from the Deadly Trolley." The overhead trolley has perhaps its disadvantages in narrow streets in the vicinity of high buildings from the fact that it might obstruct the streets in the case of fire, but with one or two exceptions the streets outlined in the applications of the Chicago companies do not cover streets in which the trolley would interfere with the work of the firemen. Should these applications not be granted an excellent opportunity will be offered to try some one of the underground trolley systems of which one at least has been given a trial in this city and since March last in Washington, D. C. This system is there used in connection with the overhead trolley system. When the end of the underground system is reached the overhead trolley is placed in position and the car pursues its way operated by the overhead system. The objection to the underground system is the extra cost of construction which amounts to a large sum. The operating expenses, however, are said to be less where the double underground trolley is used.

To the many visitors while admiring the beauty of the White City it was a matter of regret that the buildings and their contents were so soon to be removed. To many persons who had spent months in making collections and preparing exhibits the short time that they were on exhibition seemed hardly to yield a sufficient return for their efforts. As the time approached for the Exposition to close, various schemes were proposed for continuing in a measure at least the Fair or of erecting a memorial that would call to mind the White City. The plan that seemed to meet the wishes of the most people was that of a museum. By the generous gift of one million dollars by Marshall Field and smaller gifts by public spirited citizens and corporations the plan of a museum assumed definite shape. This fund is receiving constant additions in money and in World's Fair stock. Collections and articles of historical and commercial value have been given to the museum and are now being stored in the Art building until such a time as permanent quarters shall be provided. An excellent opportunity is here offered of establishing in connection with this museum a collection of electrical instruments, machines and apparatus which shall indicate the growth of the electrical industries. Electricity occupies both in its scientific and commercial fields a unique position. Its rapid advancement in commercial importance has been unprecedented. Machines and systems which a few years ago were novelties, are now almost curiosities having been superceded by more improved machines; and the apparatus of today, it is not improbable, may be curiosities a few years hence. At the Exposition there were exhibited by different persons and companies instruments and machines which were of historical value and many collections showing the succeeding steps of the development of various appliances; also models of experimental machines which could undoubtedly be secured were there some person who would make a special effort to secure and care for a collection of this kind. What would otherwise find its way to a dusty store room or possibly a scrap heap would here find a suitable place where its real value would be appreciated. No more suitable city could be found for the establishment of such a museum than Chicago. Its central location not only in reference to territory but also with reference to the electrical interests, is a point in its favor. As a great railroad center it is visited by thousands who stop to see the city, its buildings, boulevards, art galleries and museums. Persons or corporations possessing anything of historical or scientific value need not hesitate to intrust it to the care of the Columbian. Museum.

The Chicago Electric Club.

Attention was called in a recent issue to the failure of the Chicago Electric Club. Since the publication of this brief paragraph Electrical Industries has made something of an investigation into the affairs of the defunct club and finds some interesting facts that may serve to point a moral to other similar organizations.

The management under the old regime before the election of the present board, was made up principally of business men successful in their own affairs and why they should have involved the club in debts and obligations, from which it now finds it hard to extricate itself, is something extremely difficult to understand. It would seem very evident that at least some of the members of the board were negligent of their duties.

From an examination of the books the dues collected for the year ending April 1st, 1893, were about $5,200, while the expenses for the same period were about $9,500. How then did these managers expect the deficit of $4,300 to be made up, by a special assessment on the club members or voluntary contributions? Doubtless some members of the old board will be surprised to learn of these facts and probably had they known the exact state of affairs they would have been in favor of closing the rooms up long ago.

The present managers, however, should not be blamed for what their predecessors did. They consented to their election at the earnest solicitation of the old board, being led to believe that the club was in a healthy financial condition. The election occurred in April last and they set about it to find the true state of affairs. They found debts amounting to about $3,200 with a lease of $3,600 per year and other current expenses far in excess of the income. The lease, by its terms, could be cancelled only by giving notice at least 60 days before the expiration of the year May 1st. Since that date an effort has been made to close matters up as soon as possible and an assessment has been made on all the members of the club in order to liquidate the present debts and give the club a decent burial. It is certainly a most unfortünate state of affairs, to say the least, and many will contest the payment of this assessment with apparent good reasons. Many, no doubt, would pay this and do it cheerfully if they were satisfied that it would be the last assessment. We would therefore suggest to the managers that they make it a condition that upon the payment of the assessment the member be given a paper releasing him from all further liability. In this way there would be some hope of burying the Chicago Electric Club as deep as anyone could wish and forgetting that such an organization ever had an existence.

A New Fibrous Insulation and its Bearing on Underground Telegraph Lines.

BY CHAS. CUTTRISS.

Among the various electrical industries which of late years have reached enormous proportions due to the remarkable advancement in electrical science, not the least in importance is the manufacture of insulated wire. Insulated wires may be very properly divided into two classes: First, those that depend upon the insulating coating of elastic gums, such as India rubber in any of its many forms of manufacture, or gutta percha.

Second, those that depend upon a covering of fibre (such as a yarn of any kind) to keep the wire central, which is afterwards saturated with some of the many insulating materials, and protected from moisture by an outer sheath of metal, upon the integrity of which the insulation of the wire depends. Each of these classes has its special field of usefulness: India rubber and gutta percha insulated wires are used for submarine cables or when a metal protection is applied; they are also largely used for underground and interior construction. The fibre insulation, when protected with a metal covering or sheath, is generally used for underground work, but large quantities are employed in the overhead construction of telegraph and other circuits without the metal covering. During my experience with telegraph circuits it has often occurred to me that a wire embracing in part the qualities of an India rubber or gutta percha insulation with the cheapness of a fibre covered wire, was a great desideratum, and I saw no reason why such a wire should not be produced. To this end, I, in connection with Mr. A. A. Knudson, have worked for the last two years, and it can be confidently stated that the new wire, manufactured under our patents by the Phillips Insulated Wire Co., of Pawtucket, R. I., and just being placed on the market under the cognomen of "Ideal," will find a great field of usefulness as being infinitely superior to any of the existing fibre insulations and in some ways better than India rubber or gutta percha.

One trouble incident to the use of bunched cables, as they are termed, or cables consisting of many fibre insulated wires contained in one metallic sheath, is the fact that any mechanical damage to the sheath means the loss of many, if not all, of the wires as the moisture from the ground or conduit in a few hours will so penetrate the cable that the wires become crossed and grounded to such an extent as to be useless for telegraph circuits. It was one or two experiences of this nature that spurred me on to produce a wire that would combine the cheapness of fibre with the moisture resisting properties of India rubber or gutta percha. In order to do this, it became necessary to make the layer of fibre as nearly as practicable homogeneous, and for this purpose all yarns or manufactured fibres had to be discarded. Experiments were then begun on raw fibres of different kinds, and ultimately cotton in the form of a sliva as it comes from the cotton gin was found to give the best results.

The precise methods of manufacture cannot of course be detailed, but it is sufficient to state that the wire is so covered with this sliva that before saturation with the insulating material, it is so densely compacted round the wire that considerable pressure is necessary to make an indentation. After this covering with cotton the wire is placed in tanks of insulating material, and remains there until thoroughly impregnated; it is then drawn out and wiped off. For making bunched cables and many other purposes, no further treatment is necessary, but where exposed to abrasion a braid can be applied and the exterior finished in any of the well-known ways. The insulating material is of such a nature that all the ingredients are chemically combined for the reason that the fibres being so densely compacted, they act as a filter, and if the insulating compound contained any material that was only held mechanically in suspension, the suspended matter would collect on the surface, and only the thin or liquid part of the insulating material would penetrate to the wire and not give to it the dense horn-like character that is the principal moisture resisting quality.

When an ordinary fibre covered wire is bent round a small cylinder and the insulation cut so as to show the part near the wire or under the braid, an examination with a magnifying glass will show that the spaces between the yarns have become so opened that the insulating material fails to bridge the spaces, whereas in the "Ideal" wire a No. 14 copper wire can be bent round a lead pencil without any opening being discernible; in fact, when the fibre is cut with a sharp knife it shows a clear, bright, dense shaving. If the ends of the wire are left in water for weeks, the moisture does not creep back, and when wiped off and retrimmed it is in perfect condition for jointing.

The tests for insulation on wire of this kind give surprising results. Samples of 10 and 20 feet have been immersed in water for two and three weeks without breaking down, showing that a cable composed of this wire would remain intact after the lead protection had been injured for such a length of time that repairs could be affected to the injured spot without the loss of any other wire than those mechanically injured in the first case. This feature in a fibre-covered wire for underground construction is invaluable, and for overhead construction it is a very strong point in its favor, as I have not yet succeeded in breaking down the insulation by the repeated wetting and drying of two wires which have been twisted together. Hence, for passing through trees and similar places the continuance of a wet spell cannot injure the insulation of the line, at the same time the hard, horn-like character of the insulation is a great protection against abrasion.

The question of connecting cities by underground telegraph circuits has long been a mooted point, and it is a fact that, lately, some of the principal railway corporations have been investigating the feasibility of connecting the cities to which they run by cables laid in or on the roadbed of their system, and if it were not for the high cost of India rubber and the weak points of the ordinary fibre covered wires, it is possible that a cable system might have been adopted and permanent communication between cities assured, or what is of greater importance to them the integrity of their block system maintained. Cables can now be made of "Ideal" wire at a cost only slightly exceeding the ordinary fibre isulations, the integrity of which can be guaranteed and any damage, mechanical or otherwise, will be confined to the cores directly receiving it.

Arguments have been made against the practicability of working underground cables of such length at a speed sufficiently high to insure the commercial success of the undertaking. In reply to these arguments, I will make the assertion based on twenty years experience of the practical working of Atlantic cables, that underground cables can be constructed 100 to 300 miles in length, over which working speeds of 550 and 250 words per minutes respectively, can be maintained by means of apparatus which is in constant daily use, and if such lengths of cable were laid and experimented with, I am confident that in a very short time the speed would be greatly increased. These figures, I think, will not be found much below the practical speed of land lines of equal length.

One great point to be borne in mind is that the underground circuits are clear from all foreign interferences such as leaks, swings and crosses, which, more than anything else, tend to reduce the average speed of Morse working landlines to a comparatively low figure and to raise the number of errors to a high one.

Storage Batteries for Central Stations.*

BY C. O. MAILLOUX.

Since the report was read at Milwaukee, the writer has discovered therein a mistake, which is partly accounted for, if not altogether excused, by the limited time in which it was prepared, it having been, in fact, mostly written on the way to Milwaukee, owing to the delay experienced in receiving the data requisite, from various sources.

By an error in pointing off decimals, the cost of a 1,300 K. W. hour battery was wrongly given as $8,450 instead of $84,500. The saving figured out in that case, of course vanishes with the change, were it not for further corrections which can now properly be made, and which partly compensate this error. The abstracts of the paper, published by the technical press, have had the effect of waking up American battery manufacturers to a realizing sense of the importance of the results obtained in Europe, and of the necessity of their making efforts to prevent the European manufacturers from invading the field in this country. No less than three concerns have already informed the writer of their intention to immediately put large central station batteries on the market. In one case the writer was shown the plates in process of manufacture. The information obtained by the writer since the paper was read seems to show quite conclusively:

1st. That the cost of large central station batteries will not exceed $35.00 per kilowatt hour, set up, in most cases, and for smaller sizes will not exceed $50.00 per kilowatt hour.

2d. That the cost of maintenance will not exceed 10 per cent. of the initial cost.

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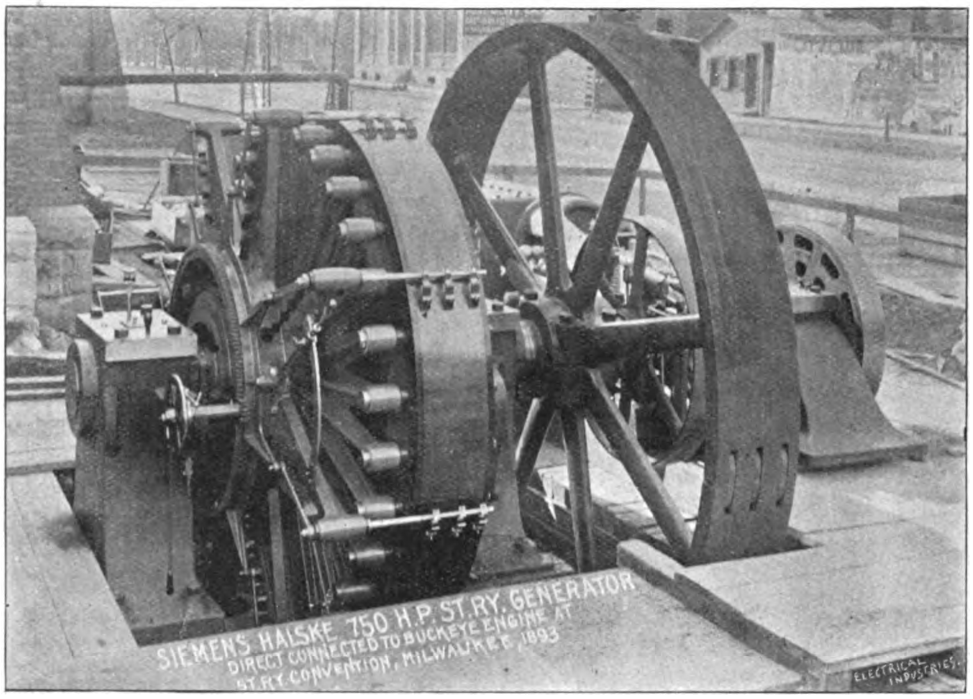
*An Appendix to a report on this subject read at the Twelfth Annual Meeting of the American Street Railway Association, October 18, 19 and 20, 1893.

3d. That the rate factor can be safely based on three hour discharge, or even less, in most cases, instead of four hour discharge as assumed in the paper.

If we make use of these amended data, we find that not only the cost per unit of battery capacity, but the total capacity itself can be reduced. In the case considered, the required capacity now becomes reduced to that determined by the quantity factor, instead of being determined by the rate factor (43 per cent more); hence a battery of 910 K. W. hours capacity will be enough. This at $35.00 will cost $31,850. The interest (6 per cent) and the maintenance (10 per cent) will make the annual cost $5,096.00. This is equivalent (for 365 days) to $13.96 per day. As the coal saved, in this case, was calculated to be 4.47 tons, it follows that the use of the storage battery would only pay if coal cost over $3.15 per ton, instead of $1.10 as given in the paper.

Equipment of a Street Railway Power House, Cincinnati.

In the earlier days of electric generation there was a wide difference between the speed at which the engines of that day ran and the speed required for the efficient operation of the dynamo. With subsequent experience and knowledge of the requirements, the speed of the engine has been increased and by the construction of multipolar dynamos the speed of the generator has been reduced bringing the speed of the two machines together and making the construction of direct connected combinations possible. Generators directly connected to vertical engines are in successful operation in a large number of stations and generators directly connected to horizontal engines are rapidly making their way to the front.


SIEMENS HALSKE 750 H.P. ST. RY. GENERATOR
DIRECT CONNECTED TO BUCKEYE ENGINE AT
ST. RY. CONVENTION, MILWAUKEE, 1893
ELECTRICAL INDUSTRIES.

EQUIPMENT OF A STREET RAILWAY POWER HOUSE, CINCINNATI.

The accompanying illustration shows a combination of this kind being installed in the power house of the Consolidated Street Railway Company at Cincinnati, as it was erected temporarily at Milwaukee during the convention of the American Street Railway Association. While there it attracted a good deal of attention. The generator is a Siemens & Halske machine of the innerpolar type, having the center magnet and fields bolted to the engine pillow block. The armature revolves at a slow speed and the commutator brushes supported on arms collect the current from the outside of the armature.

The foundation built for it at Milwaukee was of a temporary character being of wood and consequently the engine was operated at but half speed. The engine is a tandem compound Buckeye engine of 750 horse power. The cylinders are 20 and 32 1-2 inches in diameter with 36-inch stroke. It is intended to run at 110 revolutions per minute with a steam pressure of 135 pounds. The difficulty of running an engine and dynamo of this weight on a temporary foundation is evident to everyone who has ever had any experience with work of this kind and the success of the exhibit was commented on by many present at the convention.

Electricity on the Erie Canal.

On Nov. 18, the first canal boat operated by electricity from the overhead trolley system was given a public trial. The interest taken in the event is shown by the number of prominent men present. Among those who witnessed the trial were Governor Flower, Hon. John Van Voorhis, George Westinghouse, Jr., Dr. Coleman Sellers, Nikola Tesla, G. W. Balch and President Evan Thomas of the New York Produce Exchange, W. B. Rankin, secretary and treasurer of the Cataract Construction Co., Senator Parsons, State Engr. Schenck, Supt. of Public Work's Hannan, State Engr. Elect. Adams and a large delegation from the Rochester Chamber of Commerce. Electrician Chesrown, Supt. Schmidt, A. S. Morris and H. S. Clark of the Westinghouse company were present.

The Rochester Railway Co. placed two special cars at the disposal of the party which conveyed them from Powers Hotel to Brighton where arrangements had been made for the trial. Three or four thousand interested spectators had gathered on the banks when Governor Flower and party arrived. Two trolley wires had been suspended over the canal and connected with the overhead system of the Rochester Railway. A canal boat, which had been christened Frank W. Hawley for the occasion, had been equipped with Westinghouse motors and controlling devices. Two trolley arms similar to those used on electric cars were mounted near the center of the boat by which connections were made with the trolley wires.

These arms required the boat to run under the wire and when the arms would not reach the boat had to be towed under the wire. The boat was run at a speed of three or four miles an hour over the course prepared and on the return trip Governor Flower was called upon for a speech in which he said: "In 1829, when DeWitt Clinton started from Buffalo for Albany on a canal boat, he had a military company as an escort but there was no electricity to move boats or transmit news. They sent the fact of his starting, from Buffalo to New York, by the successive discharges of cannon along the bank and the time occupied was an hour and fifty minutes. The people gathered along the canal rejoicing at the improvement. Only forty tons of merchandise were sent from Buffalo to New York that year, but now 3,000,000 tons are sent through annually. I believe when this electric system is perfected there will be 12,000,000 tons sent from the west to the seaboard and without cost to the people. This experiment will give new life to the commerce of states along the great lakes and make the transportation on the Erie canal equal to that on the Mississippi. I regard it as a great privilege as governor to witness this experiment which marks the change from horse and mule power on the canal to electricity, which I believe will quadruple the usefulness of the canal."

A flexible trolley has since been used in a number of trial runs of the boat and have been found more satisfactory. With this trolley the boat will turn sharp bends or turn clear around.

Some Recent Developments in Alternatiug Current Motors.*

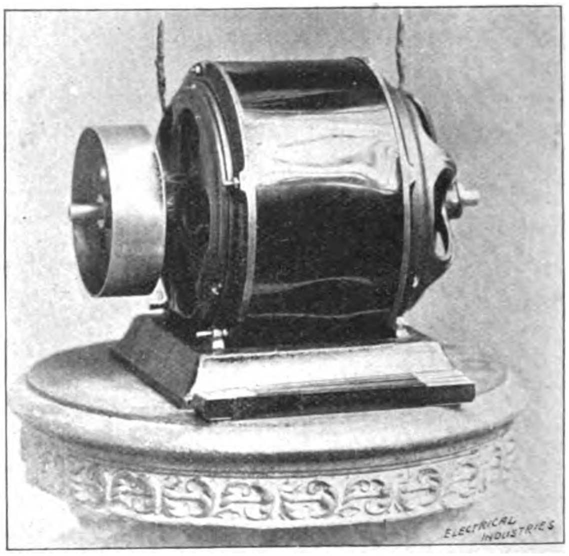
BY ELIAS E. REIS AND GORDON J. SCOTT.

Among the most interesting and valuable features that characterized the work of the International Electrical Congress recently held in connection with the World's Fair at Chicago, were the remarks made by many of the distinguished delegates present upon the subject of the transmission of alternating currents and the respective merits of single and multiphase motors for power distribution. Although opinions were somewhat divided upon this latter question, it was clearly recognized that the multiphase systems at present available were merely an expedient rendered necessary by the existing state of the art, and that the advent of a simple and efficient self-starting single phase alternating current motor would at once establish the latter as the standard type for nearly all classes of electrical power distribution.

The difficulties hitherto encountered in attempts to construct self-starting variable speed motors intended for operation on ordinary alternating current incandescent lighting circuits, have apparently been of an insurmountable nature. With the exception of the smaller types of motors developing a fraction of a horse power, such as those used for operating small ventilating fans, where economy in the use of current has been considered of minor importance and in which the self-induction in the energizing coils and the losses in the magnetic circuit could be kept reasonably small, all attempts to produce efficient motors to operate on a simple two-wire alternating circuit, without the employment of more or less complicated auxiliary starting or lag-changing devices, have thus far failed. Even two-phase and poly-phase motors as at present constructed, although self-starting under light loads, require for their efficient operation not only a low frequency that unnecessarily increases the size of the generating, transforming and motor apparatus, and which renders it in many cases unsuitable for lighting purposes (to say nothing of the greater complexity of the feeding and distributing mains which such a system involves), but owing to the great sacrifice in electrical and mechanical efficiency when their normal speed is departed from, such motors cannot compete with direct current motors for work where a variable speed with maximum torque is requisite, as, for example, in the case of electric street railways.

Following up our researches in the alternating motor field, and with the view of producing a motor of simple construction that could be operated on any of the commercial alternating current circuits now in use with reasonable economy, we built a number of experimental motors of various types and sizes embodying some of the results of our investigations.

Believing that the remarkable results we have already obtained will be of general interest at this time, we have thought it advisable to present herewith a photograph of one of the single-phase motors built and used by us in some of our experiments, together with such information concerning its operation as we are at liberty to disclose at present.



SOME RECENT DEVELOPMENTS IN ALTERNATING CURRENT MOTORS.

The motor illustrated has a capacity of one-horse power, and was designed for and tested upon an ordinary 50 volt alternating current incandescent light circuit having a frequency of 138 complete cycles per second. The most noticeable feature is its extremely small size and weight for a motor of its output and efficiency. The total height of this motor, including base, is 9½ inches, the diameter of the motor proper 9 inches, the width of motor, exclusive of end plates containing bearings, 5 inches; the total length of armature shaft, 11½ inches; while the total weight is but 35 pounds, of which only two pounds are copper.

Actual brake measurements were made upon this motor, while the same was running at various speeds on an ordinary 50-volt incandescent circuit of 138 complete cycles per second. At a speed of 2,000 revolutions per minute, taking 15 amperes of current, the motor developed 26,400 foot pounds, or .80 horse power, at an electrical efficiency of 90 per cent., the motor remaining perfectly cool after a continuous run of eight hours. With 10 amperes of current the power developed was 17,850 foot pounds, or .54 horse power, with an electrical efficiency of 93 per cent. On increasing the load on the motor, and thus reducing the speed to about 1,000 revolutions with the same flow of current, the power developed was substantially the same as before, with very nearly the same efficiency. When the speed was reduced below 600 revolutions, however, the efficiency dropped appreciably, although not enough even in the case of the present high speed machine to detract from its usefulness for continuous and effective work at speeds very much below those hitherto found practicable in direct current work.

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*Abstract.

The diameter of the driving pulley is five inches, yet notwithstanding this the torque developed by the motor is so great that it starts off promptly under full load. Another and most valuable characteristic of one type of the motor under consideration if that with a given flow of current the torque increases, up to a certain point, as the speed decreases. This peculiarity is likewise entirely new and of the utmost importance, since it not only provides an exceedingly high starting torque, but enables the motor to develop its maximum power continuously at the highest possible efficiency and irrespective of the speed at which it may run.

Since high efficiency in alternating current apparatus is the equivalent to high speed in direct current apparatus, in being the seat of the direct and counter-electro-motive forces developed, and since it is well known that by increasing the speed of a direct current armature the output of the machine for a given amount of iron and copper is very much increased, it follows that the higher the frequency that can be used the better the result obtained from an alternating current motor of a given size and weight. While there are serious mechanical limitations to higher armature speeds than those now in use, there are, so far as the motor is concerned, no longer any restrictions to the use of higher frequencies, since the self-induction and hysteresis, which in all previous types of alternating current motors have been the principal sources of loss, are now for the first time utilized, in our motor and turned to practical account, as shown by the fact that the motor runs perfectly true despite the small quantity of iron and copper in the machine. Thus, on circuits of higher frequency the alternating current motor will possess not only an enormous advantage over its continuous current brother, in the matter of safe and economical transmission over long distances of the power that gives it its vitality and scope, but will be far superior to it as a motor by reason of its more simple and compact form and the correspondingly increased amount of the power it is capable of generating per unit of weight under these conditions.

In addition to the experimental motor illustrated herewith, we have built other single phase motors of larger sizes that are doing successful work in the factory of the Ries Electric Specialty Company, where they can be seen in operation. Some of these motors are designed for synchronous working, and run at a constant speed under varying loads. As in the case of the variable speed motor they are self-starting and run rapidly up to synchronism without the use of a special starting coil or switch, and will automatically regain synchronism should their speed be temporarily reduced below it by reason of a heavy overload.

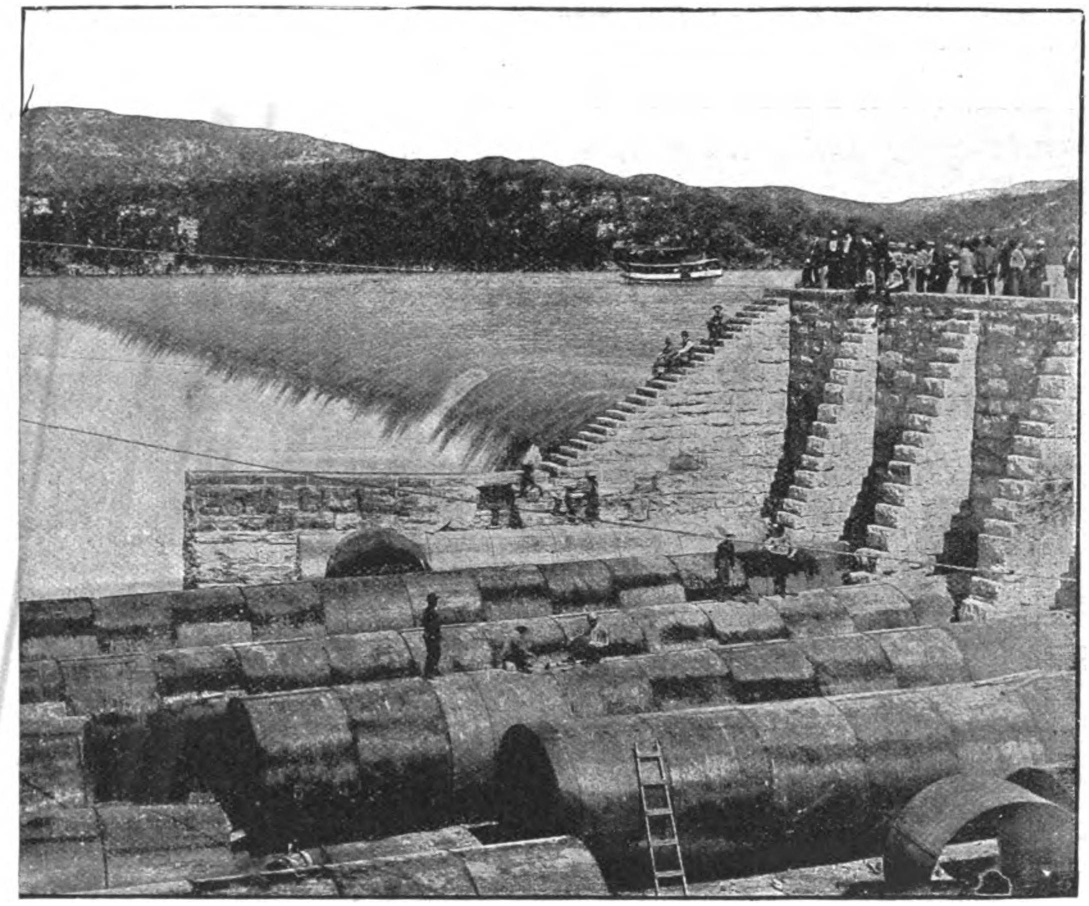


FIG. 1.—THE AUSTIN DAM.

The Austin Dam.

During the last two or three years a large amount of capital has been spent in the development of the water power of western rivers. In the accompanying cuts are shown the development of the Colorado River at Austin, Texas. The dam is 1,150 feet long, 68 feet high, 66 feet wide at the base and 16 feet at top. Its cost was about $600,000. Its construction was begun in 1890. The faces are constructed of granite and the interior of lime stone, all laid in Portland cement.

The power house is situated at the eastern end of the dam, where the full water power of the dam, which holds back a body of water 24 miles long will be utilized. The water is taken from the lake through eight penstocks nine feet in diameter. The contract for the power plant was awarded to the Stilwell-Bierce & Smith-Vaile Co., of Dayton, Ohio. Victor turbines of 24,000-horse power capacity and two pairs of four million gallon pumps, the latter for furnishing the water to the city reservoir, are being installed.

A pair of turbines is shown in the accompanying cut. They are cylinder gate on horizontal shafts with two feeders and a central discharge. The pumps are horizontal, double acting, of the plunger type, having two pump cylinders to each pair. Two 200-horse power turbines operate these pumps. The balance of power from the plant will be distributed in the form of electricity over the city of Austin for lights, electric railways and operating all kinds machinery. The cost of the entire improvement, including dam, power house, reservoir and system of distribution, is not far from $1,400,000. The pumps and turbines cost $70,000.

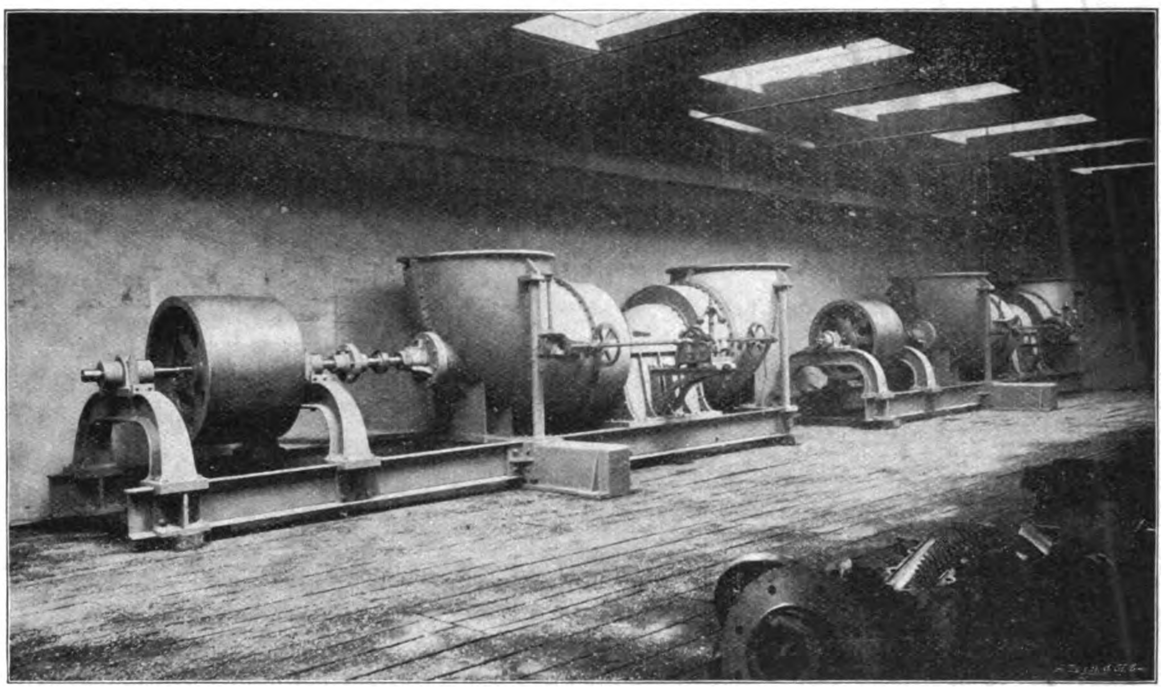


FIG 2.—THE AUSTIN DAM.

Storage Batteries on the Second Ave. Road, New York.

The operation of storage battery cars on the Second Ave. Road, New York, has been watched with a good deal of interest. The first car was started in May last, and the total mileage up to October 15 was 40,000 car miles. Since August 1 the cars have been run at five minute intervals from 6:55 A.M. to 6:15 P.M. It is said that traffic has not once been delayed by the storage battery cars.

Each car is equipped with 144 cells of Waddell-Entz storage battery and two 25-horse power single reduction motors. The battery is placed beneath the seats, being slipped in beneath the seats from the end of the car. Each cell of the battery gives an E.M.F. of .82 volts and stores about 270 watt hours, giving about 52 electrical horse power hours for the battery. The total weight of the battery is 4,200 pounds, or about 81 pounds per electrical horse power hour.

Each car has two sets of batteries, so that while one is in use the other is being charged. A car makes about 20 miles on one charge, taking about three hours, when the car is returned to the station. The facilities for changing the batteries have been planned with a good deal of care. The car is backed up to a platform, and an iron arm on the end of a cable is hooked on the battery and the battery drawn out. Rollers in the frame of the car make the transfer easy. When the battery is out the car is moved sidewise a short distance and the charged batteries are shoved in. An electric crane conveys the battery to the charging room.

The plant used at the charging station consists of two 100-horse power boilers, two 75-horse power Ideal engines directly connected to two Waddell-Entz dynamos. The Waddell-Entz battery cell is made up of copper and iron in a solution of potash and zinc. When the cell is charged the zinc in the solution is deposited on the iron negative plate, and the copper of the positive plate is oxidized. The cost of operating this line is given as follows:

Operating force	3.54	cents per car mile.	
Battery men	.75	"	"
Repair shop force	.75	"	"
Fuel	2.75	"	"
Oil, waste and water	.20	"	"
Renewals, motor gears, etc	.30	"	"
Depreciation of batteries	1.54	"	"
Total	9.32	"	"

The station could handle more cars without increasing to any extent the expense, and with 18 cars, making 80 miles each per day, it is estimated that the expense would be as follows:

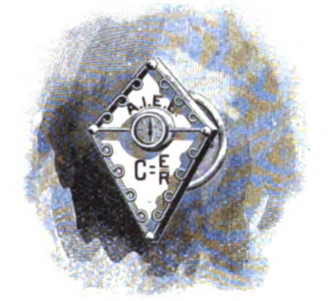
Operating force	1.31	cents.
Battery men, double present force	.42	"
Repair shop force, double present force	.42	"
Fuel	1.15	"
Oil, waste and water	.15	"
Renewals, motor gears, etc	.30	"
Depreciation of batteries	1.54	"
Total	5.29	"

American Institute of Electrical Engineers.

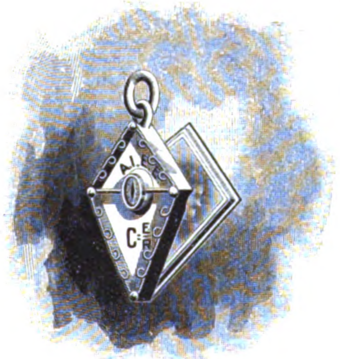
For several months the subject of holding local meetings of the institute has been under discussion. A special committee consisting of Messrs. Kennelly, Pupin, Hammer and Phelps, was appointed to consider the matter and its report was unanimously adopted by the institute at its last meeting. This report provides that where 20 or more members in any locality shall signify that such a local meeting is desired, the members shall be provided with copies of the papers to be read at the New York meeting. An honorary secretary will be appointed through whom the correspondence is to be carried on. This honorary secretary will make a report of the local meetings and forward a copy of the discussions of the papers to the secretary of the institute. The publication of these reports is governed by the same rules as the discussions at regular meetings.

The following associate members were transferred to membership: B. J. Arnold, consulting engineer, Chicago, C. D. Parkhurst, Lieut. 4th Art. U.S.A., Alfred A. Dion, electrician Chandiere El. Lt. & Pr. Co., Ottawa, Ont., Chas. F. Uebelacker, Cleveland, O., Robt. McA. Lloyd, New York. It is proposed that the institute shall undertake the publication of the proceedings of the Chicago International Electrical Congress for which no provision was made. A committee was appointed to provide for the publication.

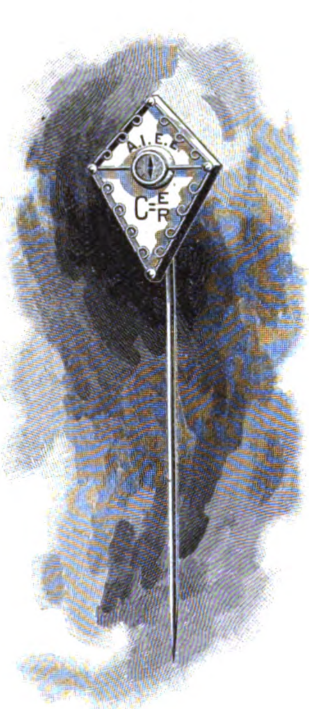
In the accompanying cuts are shown some of the forms in which the new badge of the institute is made. The design of the badge has already been described in these columns. The mountings of the badge are for a pin, a scarf pin, a lapel button and a watch charm, also as a single and double locket. The various forms are such as seem to suit the ideas of a large number and a great many members have already provided themselves with them. The certificate of the institute is a very fine steel engraving and of a very neat and appropriate design.



LAPEL BUTTON.



SINGLE LOCKET.



SCARF PIN.

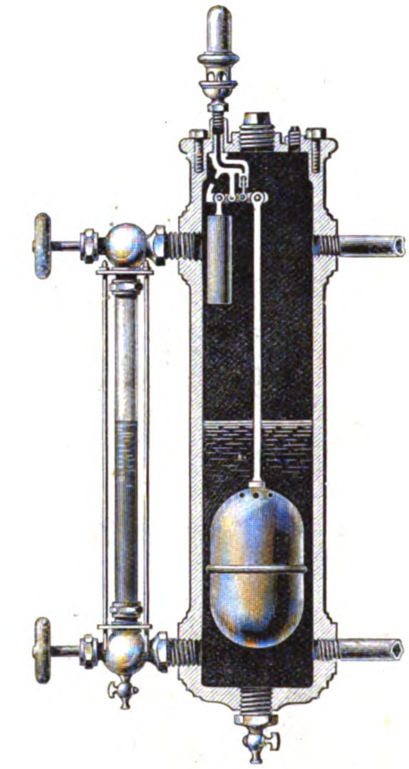
BADGES OF AMERICAN INSTITUTE OF AMERICAN ENGINEERS.

The Reed Electric Co., Camden, N. J., was recently incorporated with an authorized capital stock of $500,000. The company will manufacture storage batteries.

Ashley's Patent Low Water Alarm.

In the accompanying cut is shown a cross section of Ashley's patent low water alarm, manufactured by the Ashley Engineering Company of Hawthorne, N. J. The alarm has two connections to the boiler common to water alarms. It operates on the principle of the difference in weight of a body suspended in air and immersed in water, which gives a positive action as the following description shows:

Suspended from the underside of the cover is a valve working in combination with a double-ended lever having its fulcrum near the center. From the ends of this lever are suspended two cylinders, the upper and smaller of solid iron and the lower one with holes in its top so that when it is immersed it is filled with water. When the water stands at the desired level in the boiler and column, the solid upper cylinder is heavier than the immersed and consequently the valve is kept closed. As the water lowers the hollow cylinder projects slightly out of the water and overbalances the upper cylinder, thus opening the valve. As the water rises the lower cylinder is again immersed and the valve closed.



ASHLEY'S PATENT LOW-WATER ALARM.

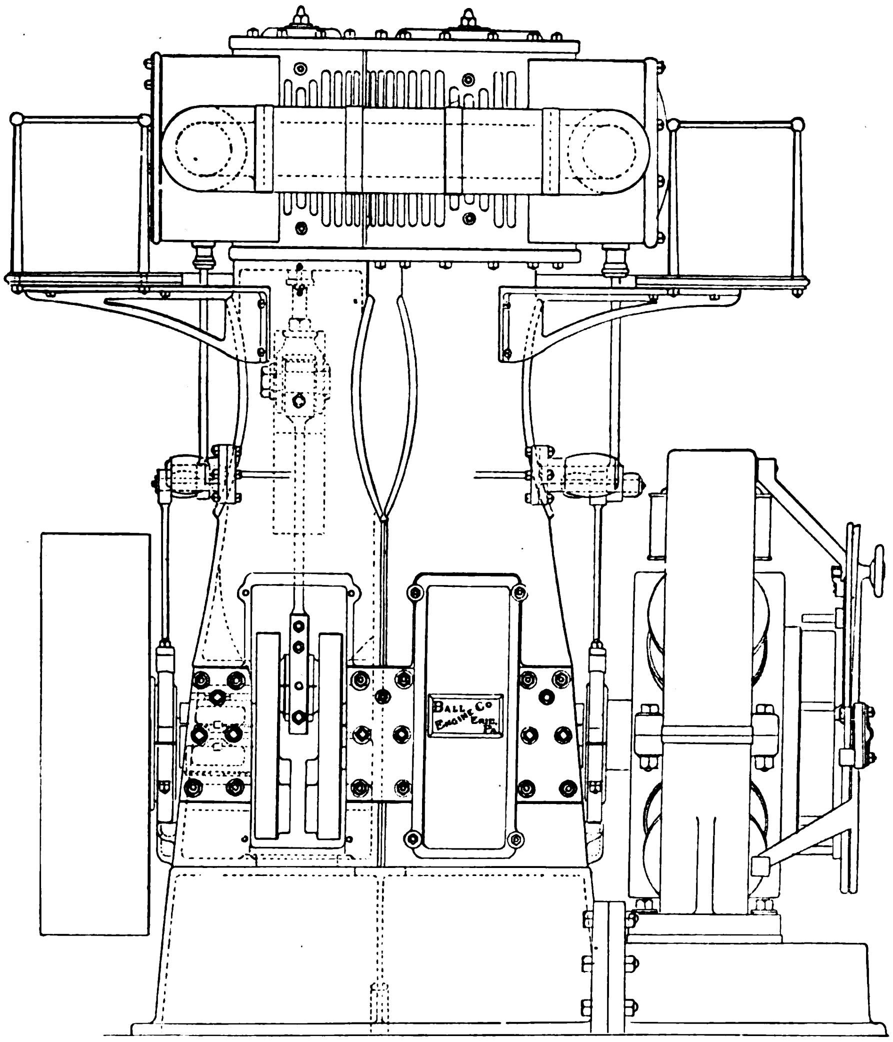
The entire mechanism, which is exceedingly simple, is attached to the cover of the column and the cover being fastened by tap screws, when these are loosened the entire arrangement may be taken out for cleaning. There is nothing to get out of order; no floats to leak and get out of repair. It is well made and forms an efficient and durable safeguard against boiler explosions. The company has had an extended experience in the manufacture of alarms and is well known through its many steam specialties in use. Mr. F. M. Ashley is the general manager of the company with an office at 136 Liberty St., New York.

A meeting was recently called of the electrical contractors and central station men of Cincinnati, to consider the new Underwriter's rules. It was proposed to raise the standard of wiring.

New Vertical Compound Engine.

With the growth of the electrical industry and the extensive construction of central stations there has arisen a demand for high speed vertical engines. The economy of the direct connection and the compactness of the combination are points much in favor of this type of engine. A new engine of this class is now being manufactured by the Ball Engine Company of Erie, Pa.

This engine has been designed with special reference to the requirements of the electric power station. It is constructed in several combinations, which at present include the cross compound, tho triple and quadruple expansion types. The cross compound is shown in outline in the accompanying illustration which shows it operating one generator. The cylinders are 16 and 28 inches in diameter with a sixteen-inch stroke. The speed is 240 revolutions per minute. It is of the enclosed form which presents a neat and clean appearance and at the same time gives easy access to all parts for inspection and repair. The shaft boxes may be removed and the shaft removed without disturbing any other part.



NEW VERTICAL COMPOUND ENGINE.

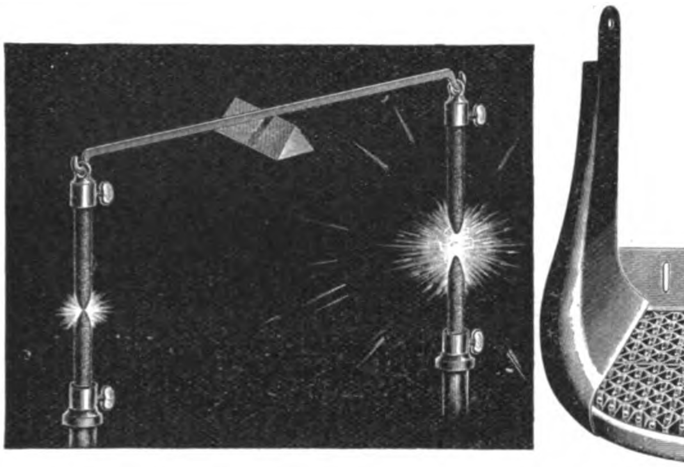
The valves are simple and durable. As orginally fitted up they are steam tight and owing to the manner of construction continue to follow up the wear without any outside attention. The valve driving mechanism is designed so that all necessary adjustments may be safely and speedily accomplished by attendants of average ability. Internal condensation is reduced to a minimum. The crank shaft is a solid steel forging from end to end, of ample proportions, and the bearings are adjustable for wear. The governor, it is claimed, will give absolutely perfect regulation with but trifling wear and exceedingly quick action.

From a mechanical point of view the engine is well constructed and well designed as to distribution of material. The facilities offered at the extensive works of the company enable every piece to be perfectly constructed. The engines are designed with reference to the constant service demanded of them. The Ball Engine Co. has had an extended experience in the construction of engines for electrical work, which these engines have the advantage of.

The See Sawing of Arc Lamps.

Where arc lamps are run two in series on incandescent circuits much annoyance has been caused by their interfering with each others regulation, the result being an alternate feeding and separating of the carbons which has been termed "see-sawing." For those who do not wish to go into theory of this action, the simple analogy in the cut may be interesting. It will be remembered that all lamps of this class has the feeding mechanism controlled by two magnets, one being on the main circuit and in series with the arc itself, while the other is a shunt around the arc. Then as the carbons burn away and the arc lengthens, the comparative resistance of the two paths for the current changes and allows the lamp to feed the carbon.

In the case of series lamps, the main current is kept practically constant by the dynamo or its regulator, and the voltage at the lamp varies. But with a pair of lamps on a constant potential circuit the sum of the voltages remains unchanged, so that the increased consumption at one lamp will rob the voltage from the other, and vice versa. In other words the left hand arc in the cut will have very little counter-electro motive force so that most of the voltage will be left for the other one and will draw the right hand pair of carbons far apart. But this action exaggerates the difference in voltage still more, until the left hand arc touches its carbons and then separates. In this way one pair of carbons will approach while the others are separating, the action being just as if they had a mechanical lever suspension as pictured. Mr. Geo. Cutter, Chicago, holds that this see-sawing is one of the greatest problems met in adapting arc lamps to incandescent circuits, but he thinks it is well met by the peculiar design of the Waterhouse lamps, and it is said that users bear out his statement. At any rate the pictured analogy is interesting as showing a drawback which has at last been overcome.



THE SEE-SAWING OF ARC LAMPS.

The attack on the overhead trolley was almost forgotten in contemplating the capricious actions of the north and west side cables during the past two weeks. A raised man-hole cover recently stopped a car so suddenly as to pitch the gripman and passengers in the forward end of the car into the street and injured nearly twenty persons.

The Stanwood Step for Electric cars.

A number of improvements have been made in the Stanwood steel step, both in the material used and the method of construction. The frame that surrounds the steel strips of the step tread is now made of rolled steel in place of malleable iron. The addition of a straight strip of steel extending through the center and entire length of step tread, prevents sagging.

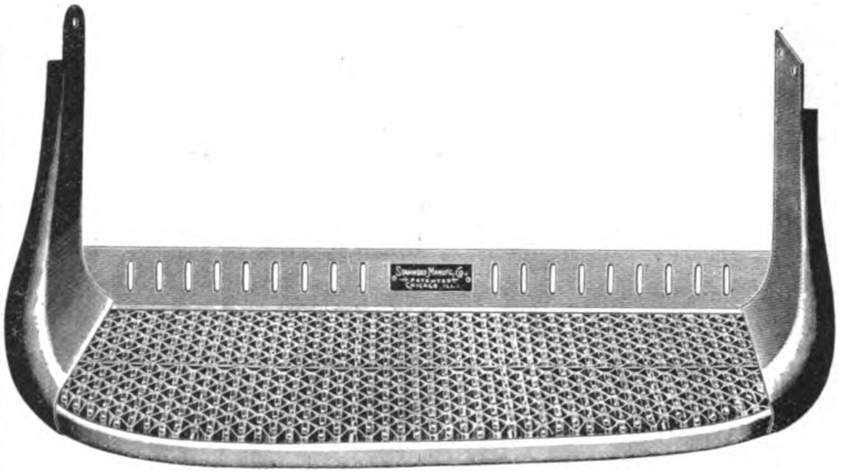


FIG. 1.—THE STANWOOD STEP FOR ELECTRIC CARS.

The accompanying cuts show the detail of construction. The tread is composed of thin strips of Bessemer steel ⅞-inch wide, square sheared and bent alternately to opposite sides of a straight line. The steel strips A, when assembled together, are interlocked by bosses A' stamped thereon, shown in the cross section of step tread, which prevents vertical motion of the strips when in the surrounding frame of rolled steel. The rods that pass through the steel strips, frame and toe guard, prevent the frame from spreading, and are made of Swedes iron, hot forged heads and nuts. The extra nut secures the toe guard to the step tread. The hangers E and E', made of pressed steel with double flanges and recess G, for the tread, are securely fastened to the frame of the step tread by special bolts. The toe guard

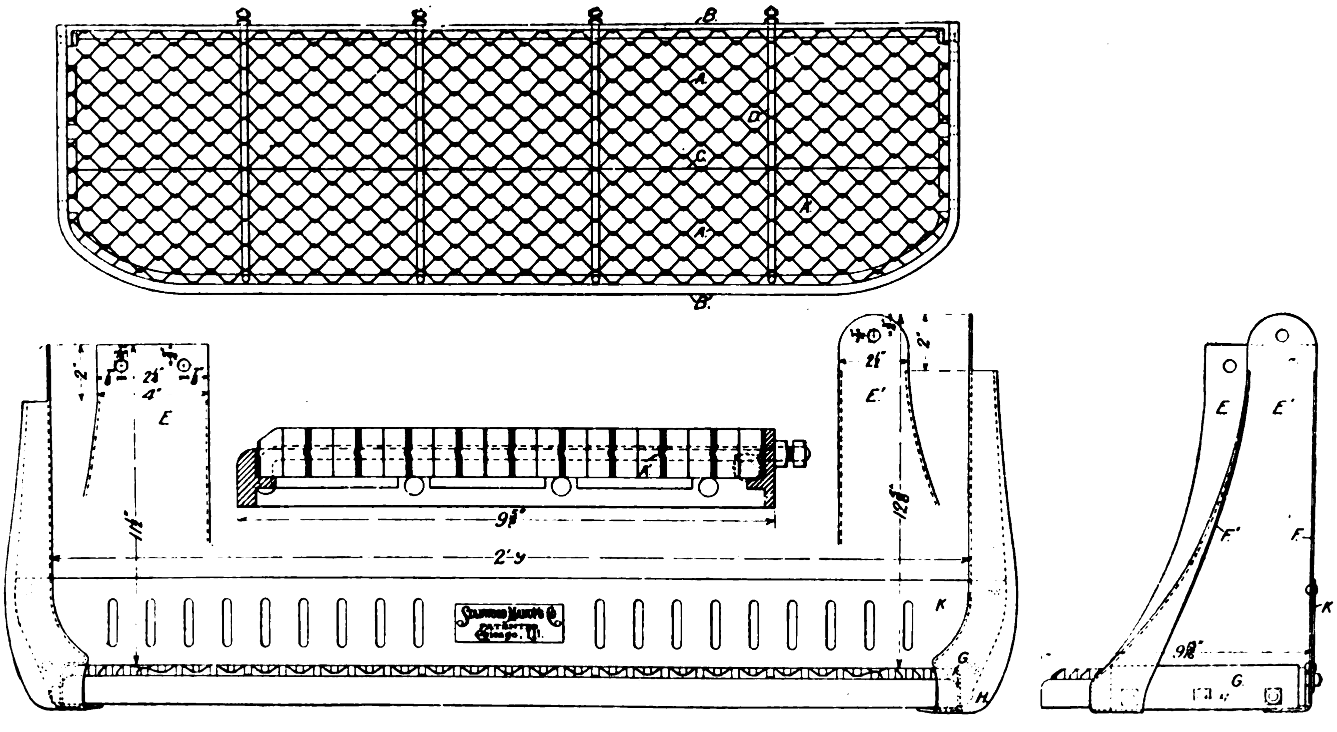


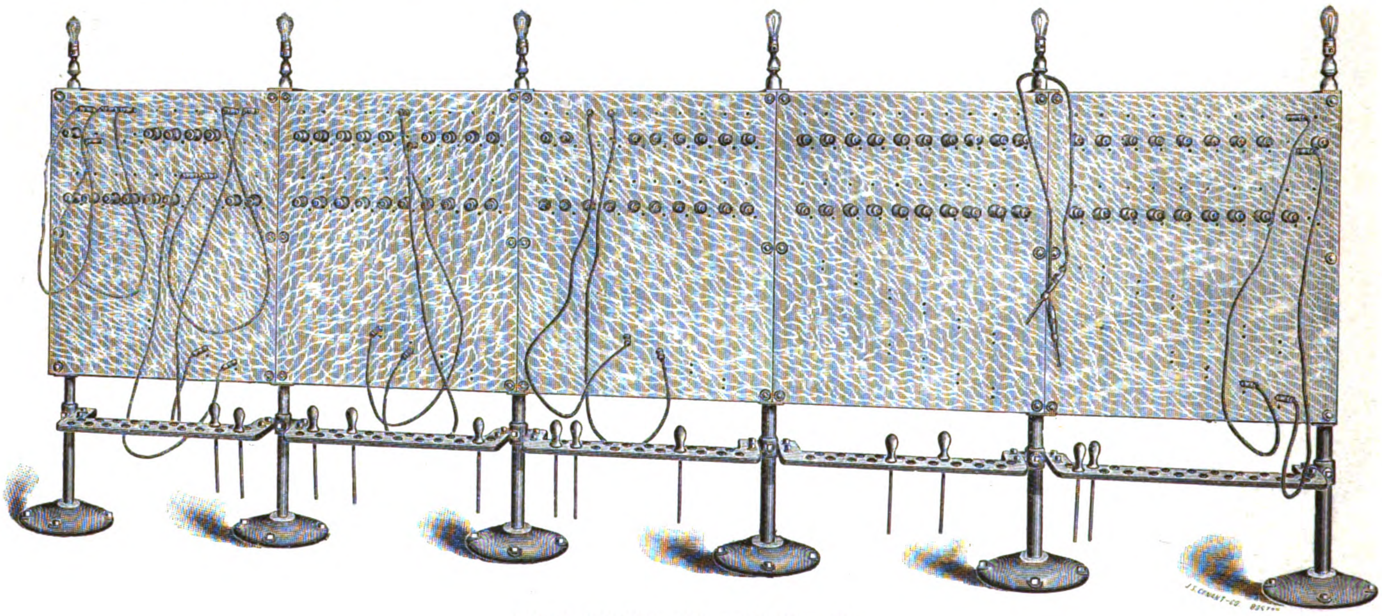
FIG. 2.—THE STANWOOD STEP FOR ELECTRIC CARS.

is made of sheet steel and the ends are securely riveted to the flanges of the hangers.

The surface of the tread is three-eighths of an inch above the upper end of the front of the frame, and by slightly beveling the first row of the crimped strips, a non-slipping edge is produced. The steel strips being square sheared prevent the boot from slipping, and as the apertures formed by the bent strips are only three-quarters of an inch, the sole of the boot cannot round off the edges but will continue to keep them sharp. The openings admit the free passage of mud, snow and ice, and the tread forms a good scraper, thus making cleaner cars. A safe foothold is always assured and accidents getting on and off avoided. The merits of the step have brought it before the managers of the roads of the country until 468 roads are now using them. The steps are manufactured in five styles and 78 sizes by the Stanwood Mfg. Co., Chicago.

Fifty Circuit Arc Switchboard.

The more advanced practice in central station construction is the building of the different parts from plans, designed with special reference to the requirements of the particular plant. This is especially true in the construction of switchboards and their equipments. This work has been undertaken by a number of companies of whom none is better known than the W. S. Hill Electric Co., of Boston, Mass. The accompanying cut shows some of its special work in the shape of a 50 circuit arc switchboard, built for the Narragansett Electric Lighting Co., of Providence, R. I.

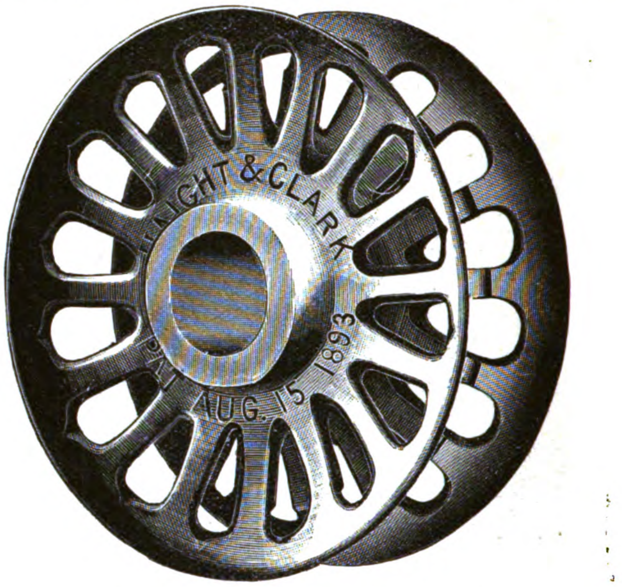


FIFTY CIRCUIT ARC SWITCHBOARD.

Some of the most noticable things about the board are the clear, unencumbered face of the board, the simplicity of its construction and its substantial appearance. All the connections and contacts are blind fastened to the back of the board in a rigid manner. Avoiding the use of bolts that pass through the board there are no metal surfaces to mar its appearance or to be dangerous to the attendant. The company has recently completed several large boards among which was one for the Lynn Gas & Electric Co., for 24 circuits, and has a number in the factory in process of construction. In the construction of switch board apparatus a large business has been built up. Among recent shipments one aggregating three and one-half tons in weight and including switches up to 4,000 amperes capacity was made.

An Ice and Sleet Cutting Trolley.

In the accompanying cut is shown an ice and sleet cutting trolley wheel, manufactured by Haight & Clark, of Albany, N. Y. The wheel is designed to remove the incrustations of ice, which form on the trolley wire and prevent a perfect contact. It has been used during the past two winters on the Albany Railway and has given excellent satisfaction.



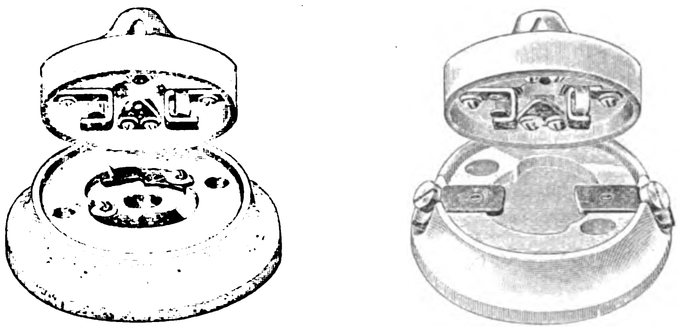
AN ICE AND SLEET CUTTING TROLLEY.

It makes no difference how heavy the coating of ice may be, a car fitted with one of these trolley wheels moves along as perfectly as on a clear wire. The shape of the wheel is such that it cuts the ice and gives a good contact at the same time. The wheels are made of aluminum bronze which gives strength and durability.

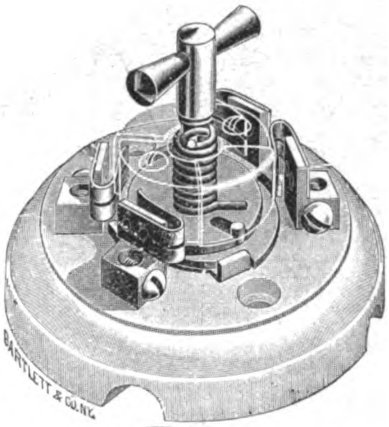
The Park Commissioners are considering the advisability of purchasing some of the electric launches which were used at the Fair for use in the different parks of the city. The investment would undoubtedly be a good one and would not only yield a return in money, but would also form an attractive feature of the waterways of the parks. The batteries could be charged from the city plants and thus the expense would be the actual cost.

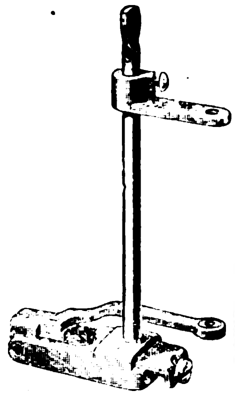
Specialties of the Metropolitan Electric Co.

Having seen at its ware-rooms something of the large quantities of electrical supplies handled by the Metropolitan Electric Co., it was proposed that a visit be made to the factory of H. T. Paiste, whose specialties it markets exclusively. The visit enabled us to see the various articles which occupy so important a place in every electrical installation manufactured step by step, until completed. First in importance was the making of the eccentric switches. An important feature in the switch, as shown in the cut, is that all brass parts are fixed firmly to the porcelain without the use of screws. In porcelain there is "no cushion," hence screws will sooner or later jar out. The movement is of the eccentric order, thus insuring a positive mechanical action. The electrical contact is made by solder contacts. We witnessed a test made on the five ampere switch. This switch had been run for four days, making thirty breaks a minute, a total of about 70,000 half revolutions, more than a switch would be used in fifty years. It was carrying a load of 25 amperes at that time and did it without heating the contact parts. The breaking capacity will easily break 500 volts. The switches are single and double pole, also three way.

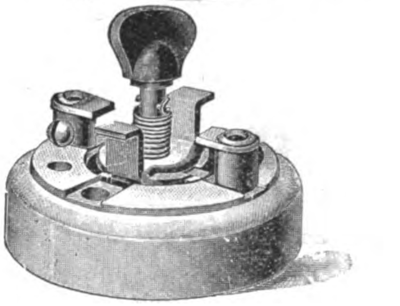


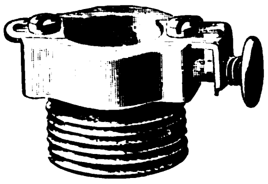
FIGS. 1 & 2.—SPECIALTIES OF THE METROPOLITAN ELECTRIC CO.


BARTLETT & CO. N.Y.



T-H CLUTCH.





T-H BUSHING.

FIGS. 3-6.—SPECIALTIES OF THE METROPOLITAN ELECTRIC CO.

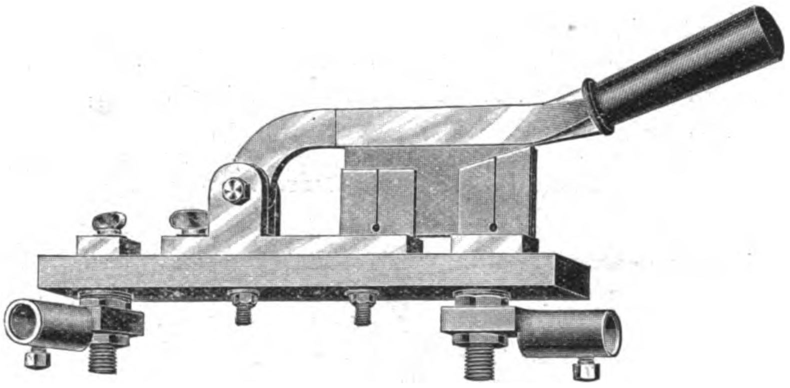
We next visited the cut-out department. Here is made in large quantities the Paiste ceiling cut-out (Schaffer style) for open and concealed work. The attached cuts will readily demonstrate the simplicity and beauty of their design. Those who visited the Electricity Building at the World's Fair will remember the very neat and artistic design made by the cut-outs in Mr. Paiste's exhibit. Main and branch cut-outs of the S. M. and Edison style are made in large quanties. A new covered branch and main has just been manufactured that will be much appreciated by the electrical trade. A covered horse-shoe cut-out is in process of manufacture and will be ready to deliver in a short time.

We next visited the stamping department and there saw them making out of flat sheet metal a clutch for T. H. arc lamps. The attached cut will illustrate the design and movement. The feature of this specialty is that it can be adjusted to a carbon rod and, therefore, is practically indestructible. German silver contacts are used throughout.

Here also is made an adjustable lower contact bushing for T. H. arc lamps; the cut will easily illustrate the simplicity of the device. Numerous screw machines were running, turning out binding posts and various other articles. Another department just being organized was the making of switch boards, etc. Here men were busy making a complete set of switch and cut-out boards for the Ryerson Library.

New Lang Switch.

Something new in switches has just been placed on the market by J. Lang & Co., of 44 Michigan St., Chicago. The switches are made up without bases and are designed to be mounted on the switchboard itself. The accompanying cut shows the method of mounting and the connections for the line on the back of the board. It is thus one of the simplest switches made and yet every part is of the same substantial and durable character. The clips and blades are made of hard rolled copper; the body of a special composition metal of good conductivity. The contacts and connections are made the fewest possible and these are so constructed that they offer the least resistance to the current. Single, double and three pole switches are made in this style both in the single and double throw. The sizes are sufficiently numerous to meet the requirements of almost every board.

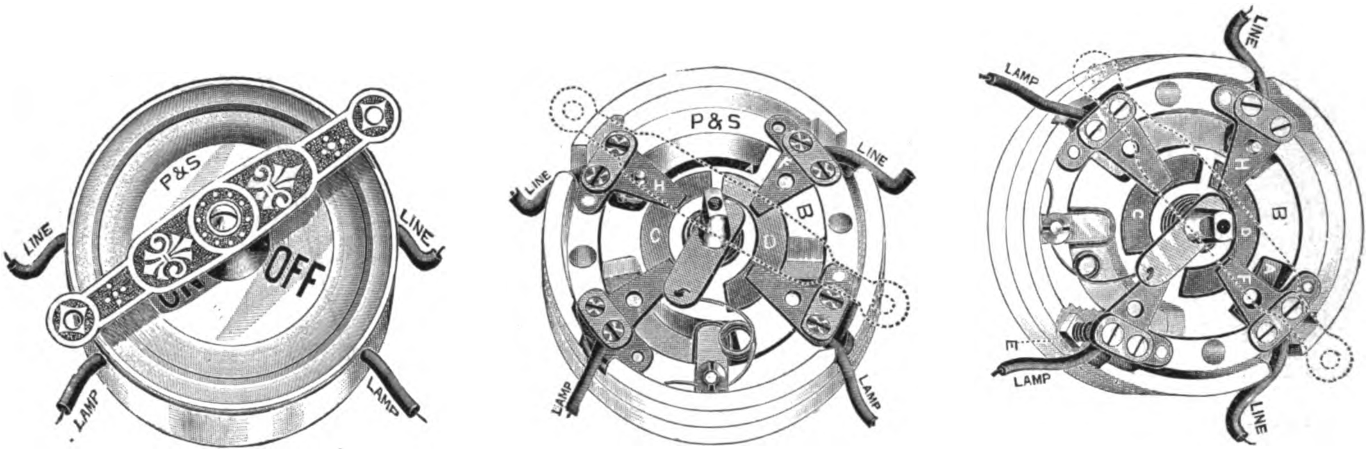


NEW LANG SWITCH.

"P & S" All China Arc Cut-Out.

Something new in the line of arc cut-outs is shown in the accompanying cuts. One of the chief features of the cut-out is the perfect insulation afforded. The case, cover and circuit breaking cam are made of china, thus avoiding all liability to grounds during wet weather. It is neat and substantial in appearance without being clumsy. The handle is nickel plated, ornamental, and can be operated either by a cord or by pole and hook. It can be placed in any position, at any distance from the floor, and yet be operated with ease.

The cut-out is shown complete in Fig. 1, with cover and handle on. In Fig. 2 the lamp circuit is shown cut out. The line circuit is made through contacts F and H, D and lever A. By turning the handle the china cam B is turned to right, carrying plates D and C with it and passing between contacts F and lever A, breaking the line circuit and throwing in the lamp circuit as shown in Fig. 3. There is no arcing on plates C and D when line circuit is broken, as D leaves H before B opens the circuit by passing between F and A.



FIGS. 1-3.—"P. & S." ALL CHINA ARC CUT-OUT.

The cam B is moved very quickly by means of the tortion spring on the handle post, and as it passes between A and F the arc is blown out by the puff of air produced by the sudden motion of B. Spiral springs hold the plates C and D against the contacts. The clamps for line wires have two heavy screws in each and also nut and spiral spring as shown at E in Fig. 2. A perfect contact is always insured.

Some Fine Sample Boards.

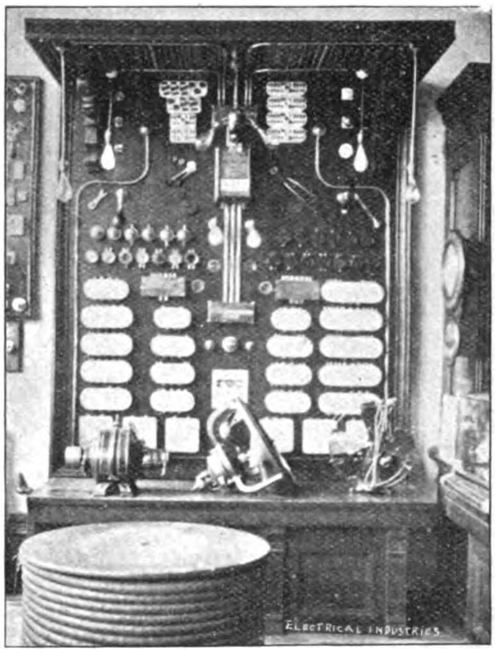
A large percentage of the goods sold at the present time, is sold from samples. To allow a customer to select his purchases from the goods in bulk would require large salesrooms or storerooms, and the matter of selection alone would consume considerable time; while, with the present system, the different sizes, styles and designs of goods are shown by samples in cases or on display boards, which greatly facilitates the transaction of business.

In the electric supply trade, which handles innumerable small articles, as well as large, this method has been generally adopted and the system perfected in a remarkable degree. In the salesrooms of the Central Electric Co. are a number of particularly neat and attractive sample boards. Each board presents one line of goods and shows every size and kind. In the accompanying cut is shown the sample board on which is displayed the interior conduit system of wiring of the Interior Conduit & Insulation Co., for which the Central company is general western agent. The different sizes of tubes used, the various kinds of fittings, the junction boxes and cut-outs, as well as the tools used in its installation, are shown on this board. It occupies but little space in proportion to the large number of articles shown.

Other appliances and specialties are displayed on separate boards arranged with such care that the salesrooms present an elegant appearance. The great value of this method is in the ease and quickness with which orders may be filled and verified.

National Electric Light Association.

Washington, D.C., was the place selected by the executive committee for holding the next convention of the National Electric Light Association. A special meeting of the executive committee was called at the Lafayette Hotel Philadelphia, on Friday, November 24th, for choosing a place of meeting and appointing the committees for making the necessary arrangements. The convention will be in session February 27th, 28th, and March 1st, 1894. The following committee on arrangements was appointed; Mr. C. O. Baker, Jr., chairman, Mr. F. W. Royce, Washington, D.C., Mr. Samuel M. Bryan, Washington, D.C., and Mr. M. J. Francisco, Rutland Vt.; the committee on program consists of Mr. A. J. DeCamp, chairman, Mr. C. W. Price, New York, Mr. H. H. Fairbanks, Worcester, Mass.



SOME FINE SAMPLE BOARDS.

Successful Conduit Test.

At the new plant of the Co-Operative Electric Light Co., corner Elm and State St., Chicago, the current was turned on Nov. 22 for the first time to the underground conduit system put in by Cummings & Engelman Conduit Co., of Detroit. In this system a bare copper conductor is used in the underground tubes and 2,000 volts alternating current was sent over the line without any difficulty. This test is of special interest as it is claimed that this is the first time in this country that such a high voltage has been used successfully with bare copper conductors. The Cummings & Engelman Conduit Company is to be congratulated upon the success of its system.

Cutter's Motor Switch.

Among the new devices which helped to make George Cutter's exhibit at the World's Fair, and which we mentioned in a previous number, were a series of main switches embodying a number of novel features. Those shown covered a wide range of sizes, but were all designed for use on incandescent circuits having a pressure of two hundred and twenty volts or less. Encouraged by his success with these, Mr. Cutter has now brought out a small switch especially designed for use with motors on 500-volt circuits, and one that will no doubt meet with favor in electric railway circles.

The handle is fastened to a yoke-piece which has fingers engaging the switch-blade, the two parts being connected by a compression spring. This spring insures a snap action, giving a quick and positive break that prevents any arcing. Of course the parts are mounted on a slate back, and the switch as a whole is quite a neat and compact device. There has been a growing demand for a good switch of this sort, as most electric railways are renting out current for small motors, hence this form ought to find a ready sale. It is made by George Cutter of Chicago.

Taylor, Goodhue & Ames.

This firm was incorporated in Chicago in October, 1892, the active members being as indicated by the name. During the year some changes were made in the personnel of the firm, the active members now being Mr. Wm. Taylor, president and treasurer and Mr. A. W. Dee, secretary.

Mr. Taylor, the president, is perhaps best known in electrical circles through his long connection with the Electrical Supply Company, having held the position of assistant manager of that concern since it started business in Chicago until September 15th, 1892—a period of about seven years.

Mr. Dee was also connected with the Electrical Supply Company for a number of years, resigning his position March last and buying an interest in the firm he is now secretary of.

Mr. F. D. Mack has been connected with the firm since its start and to his energy, perseverance and ability full credit should be given when adding up the causes which have led to the success of the first year's business. It is contemplated that the name of the firm will be changed and additional capital introduced about the beginning of the year.

The W. S. Edwards Manufacturing Company.

With the development of incandescent lighting has grown up the enormous electric fixture business of today. There are now a large number of factories equipped with the latest improvements for the manufacture of this artistic part of electric lighting. The business originally started in the east but at present the west claims its share of this important class of manufactures. One of the most notable examples of growth and development in the manufacture of this class of goods is the W. S. Edwards Manufacturing Company, 21 & 23 Lake St., Chicago. This company has been in existence for some five years and within that time has trebled its business. During the past season in order to accommodate its rapidly expanding business the company was obliged to move to its present quarters where it occupies a whole five story building and basement with a frontage of 33 feet with a depth of 170 feet.

In taking up its new quarters the company considered all the requirements and spared no pains to have its factory, offices and salesrooms most conveniently arranged for the conduct of its business. On entering the store a person sees fixtures of all kinds suspended in the main salesroom. To the left of this main entrance are the salesmen's desks while to the right are the general business offices of the company. Mr. W. S. Edwards, the president of the company, has his private office a little off from the general salesrooms while that of Mr. John Schaaf, the treasurer, is on the opposite side of the room. In the front to the right is the office of Mr. F. S. Beardslee, the secretary of the company, back of whose office are the rooms assigned to the book-keepers, stenographers, etc. The remainder of the first floor is divided into salesrooms in which are assembled the fixtures of all the latest designs. These salesrooms are six in number and so arranged as to show the differens styles and designs to good advantage, the various fixtures used for stores, offices, houses, etc. In the basement is the stock room in which are to be found the manufactured fixtures when complete also the necessary glassware and miscellaneous goods. The shipping room is also located here. The engine and boiler rooms are located in the rear of the basement and extend out under the adjoining court. The boiler plant consists of two 65-horse power boilers while the engine is a 90-horse power Corliss machine, which is used for running the dynamo that in turn furnishes current for both the power and light used in the factory and throughout the building.

The factory occupies the upper floors, the top floor being given up to the foundry, polishing and plating departments. On the fourth floor is located the stock room for brass goods together with the chandelier maker's room where the brass is worked up; that is, spun, bent and brazed and in fact made into electroliers before going to the floor above to be polished and finished. The third floor is used for building up the fixtures or putting them together, every fixture being thoroughly tested before going out of the factory. After having been tested the fixture is taken apart for shipping and carefully wrapped in paper. The designers, modelers and chasers are located on this floor. The building is lighted throughout by means of a 70 h. p. dynamo of the Eddy make and installed by Kohler Bros., the western representatives of the company. The factory is operated throughout by means of two 5. one 10 and one 30 horse power motors, which are also of the Eddy type. About 100 men at present employed throughout the factory although the season is comparatively dull.

The position which the company holds in the manufacture of this class of goods is a commanding one and the well earned reputation for workmanship and quality which it enjoys has enabled it to keep its factory in operation constantly during the dull times. Its goods are well and favorably known everywhere and the fact that the company is progressive and constantly getting out new designs enables it to take rank among the first manufacturers in the country in this line.

ELECTRIC LIGHT AND POWER

EXTENSIONS AND IMPROVEMENTS.

FAIRMONT, MINN.—St. John & Company contemplate adding an arc dynamo.

MANHEIM, PA.—A plant is very much needed. Who will come and organize a company?

BLOOMINGTON, ILL.—The Citizens Gas Light & Heating Company will double its present capacity.

DECATUR, ILL.—The Municipal Electric Company will soon add an arc machine. J. H. Culver is purchasing agent.

ELGIN, ILL.—The municipality will add about twenty arc lamps during the coming year. H. E. Shedd is purchasing agent.

RIVERPOINT, R. I.—The Peoples Edison Illuminating & Power Company contemplate the addition of 1,500 incandescent lights.

KANSAS, ILL.—Mr. Ira W. Langford (successor to John T. Staff), contemplates an extension of lines, including a residence circuit.

ALEDO, ILL.—The Aledo Electric Light & Power Company will add more arc lamps for street lighting. Vincent & Lair, proprietors.

CHICAGO, ILL.—The Hyde Park Electric Light & Power Company contemplate an extension of lines, and the erection of a second station.

MORRISON, ILL.—The Morrison Electric Light & Power Company proposes to increase its dynamo capacity. H. S. Green is purchasing agent.

HAMILTON, O.—Municipal light plant to be installed. People have voted to issue bonds to the amount of $50,000. Henry Welch, chairman of light committee.

METROPOLIS, ILL.—The city of Metropolis will add to its plant two engines, boiler, steam pump, dynamos and lamps. Thomas L. Davis is purchasing agent.

DETROIT, MICH.—Work has begun on a municipal plant of 2,000 arc light capacity and it is expected to be in operation by next August. Alexander Dow is City Electrician.

AVON, ILL.—The Avon Milling & Mining Company will construct a tramway for hauling clay and use electricity as a motive power. H. F. Townsend is purchasing agent.

BLUE ISLAND, ILL.—The municipal plant is to have its equipment largely increased by the addition of a dynamo, engine and boilers. Fred. Hohmann is purchasing agent.

LA FAYETTE, IND.—La Fayette Street Ry. Co. has elected new officers as follows: President, Frank W. Ritter; vice-president

T. J. Levering; general manager, J. S. Hill; secretary and treasurer, J. T. Henderson. A number of improvements are being made.

CHILLICOTHE, ILL.—The Chillicothe Water Electric Light & Power Company contemplate the installation of an incandescent system next year. J. S. Daily is purchasing agent.

BRANCHVILLE, N. J.—The Branchville Electric Light Plant, owned by Mr. C. H. Cusman, commenced operation Sept. 18, 1893. Forty 32 c. p. lamps will be added for street lighting.

FINANCIAL.

An evidence of the improved condition of trade in general and of the electrical trade in particular is found in the list of new central stations projected and improvements contemplated of the old electric light and power stations as reported to us during the month. The different manufacturers of electrical apparatus report an increase of orders, and several that have been running during the summer with greatly reduced forces and on short hours are again at work and expect soon to have their usual force at work. The supply houses have found a greater demand for supplies than during any recent month. Prices have ruled low, and buyers with cash have been able to secure remarkably low figures. The feeling is general that business will continue to improve. Reports from different parts of the country show that the industrial condition is better.

NAME OF COMPANY.	DESCRIPTION OF SECURITY.	AMOUNT ISSUED.	PAR VALUE.	RATE INT.	DATE PAYABLE.	CLOSING NOV. 29.
Miscellaneous Securities.						
American Bell Telephone Co.....	Stock.	$17,500,000	100	....	J. Q.	189
“ “ “	Bds. 1893.	2,000,000	100	7	F. & A.	107
American Tel. & Cable Co... ...	Com.	14,000,000	100	....	....	90
Commercial Cable Co	Com.	7,716,000	100	....	....	120
Edison Elec. Ill. Co., Boston ..	Com.	2,025,800	100	....	F. Q.	124
“ “ “ ...	C. Bds. 1898.	71,000	100	6	M. & S.	.....
“ “ “	C. Bds. 1901.	586,500	100	6	M. & N.	.....
“ “ Brooklyn..	Com.	2,500,000	100	....	Q. F.	85
“ “ “ ..	1st. 1940.	500,000	100	5	A. & O.	.....
“ “ “ ..	Regis.	....	100	5	A. & O.	.....
“ “ Chicago...	Com.	3,000,000	...	8	Q. F.	.....
“ “ “		2,500,000	....	....	....	.....
“ “ New York.	Com.	7,9 8,000	100	....	Q. F.	97
“ “ “	1st 1910.	2,562,000	100	5	M. & S.	100
“ “ Phila......	Com.	1,473,000	100	....	....	120½
“ “ “	... ...	....	5		....	.....
Fort Wayne Elec. Co...... ..	Com.	4,000,000	25	....	....	4½
General Electric Company.	Com.	30,457,000	100	....	....	37¼
“ “	Prf'd.	4,251,900	100	....	....	62
“ “	Deb. 1922.	10,000,000	100	5	J.-D.	71
Gold & Stock Tel. Co....	Com.	5,000,000	100	....	Q. J.	... .
Northwestern Gen. Elec. Co....	Com.	1,000,000	100	....	....	.....
“ “ “	Prf'd.	750,000	100	....	J. Q.	.....
Thomson Elec. Welding Co......	Com.	1,000,000	100	....	....	.....
Thomson European Welding Co.	Com.	1,500,000	100	...	....	.....
Thomson-Houston Elec. Co . .	Series D.	1 0,000	10	....	....	5⅝
Thom'n-Houst'n Intern. Elec. Co.	Com.	600,000	100	.	....	.....
“ “ “ “	Prf'd.	400,000	100	....	....	.....
United Electric Securities Co....	Com.	1,000,000	100	....	....	.....
“ “ “	Prf'd.	1,000,000	100	....	F. & A.	....
Western Union Tel. Co	Com.	94,820,000	100	....	Q. J.	91¼
“ “	Var. Issues	13,088,000	10	7&5	M. & N.	.....
West'gh'se Elec. & Mfg. Co	Ass' ing.	5,333,940	50	....	....	27
“ “ “	1st Pf. Cum.	3,755,700	50	7	....	46
Electric Railway Securities.						
BROOKLYN—						
Brooklyn City R. R...............	Com	6,000,000	10	....	Q.-J.	170
“ “	1st Bds. 1916	3,000,000	100	5	J. & J.	90
Coney Island & Brooklyn R. R..	Com.	500,000	100	....	Oct. 1.	.....
“ “ “ ..	1st Bds. 1909	300,000	100	5	J. & J.	.....
“ “ “ ..	Certf. 1894.	300,000	100	6	J. & J.	.....
BUFFALO—						
Buffalo St. Railway...............	Com.	5,370,500	100	5	....	.....
“ “	Bds. 1931.	5,000,000	100	....	F. & A.	.....
BOSTON—						
West End St. Railway...........	Com.	9,085,000	50	..	J. & J.	58
“ “	Prf'd.	6,4 0,000	50	5	J. & J.	80
“ “	Bds. 1902.	3,000,000	100	....	M. & N.	.....
LOUISVILLE—						
Louisville St. Railway Co........	Com.	5,000,000	100	....	....	.....
“ “	Prf'd.	1,000,000	100	5	A. & O.	.....
“ “	1st Bds. 1930	6,000,000	100	....	J. & J.	.....
NEWARK, N. J.—						
Newark Passenger Railway......	Com.	6,000,000	100	....	....	27⅜
“ “	Bds. 1930.	6,000,000	100	5	J. & J.	84⅛
NEW YORK—						
Union Railway Co	Com.	2,000,000	100	....	....	155
“ “	Bds.	2,000,000	100	..	....	.....
PITTSBURGH—						
Duquesne Traction Co....... ...	Com.	3,000,000	50	...	....	23
“ “	Bds. 1930.	1,500,000	100	5	J. & J.	98
Fed. St. & Pleas. Val. R. R.......	Com.	1,500,000	50	....	J. & J.	19
“ “ “ “ “ ..	Bds. 1919.	1,250,000	100	5	J. & J.	100
Pittsb'gh, Aleg. & Man. R. R....	Com.	3,000,000	50	....		38
“ “ “ ..	Bds. 1931.	1,500,000	100	5	J. & J.	100
Pittsburgh & Birming. R. R. ..	Com.	3,000,000	25	....	......	10⅛
“ “ “	Bds. 1929.	1,500,000	100	5	M. & N.	98
ROCHESTER—						
Rochester Railway Company....	Com.	5,000,000	100	...	....	.....
“ “ “	Bds. 1930.	3,000,000	100	5	A. & O.	95
ST. LOUIS—						
Lindell St. Railway..............	Com.	2,500,000	100	....	Q.-J.	60
“ “	Bds. 1910.	1,500,000	100	5	J. & J.	87
St. Louis & Suburban............	Com.	2,500,000	400	....	....	50
Union Depot Railway............	Com.	1,200,000	100	...	....	.....
“ “ “	Bds. 19 0.	1,000,000	100	6	A. & O.	100

* And interest bid.

The stock market does not show any marked advance in prices. Many stocks have experienced heavy declines, but recovered largely toward the close of the month. General Electric continues to be the football of Wall St. Its decline to 33 without any special cause shows how easily its price is influenced. It is said that the company is not at present embarassed for money, but that its business as conducted on the cash basis has been about one-half of the business done during the same time last year. The report that the company would default the interest due of the debenture bonds on December 1 is denied, and that the money to pay the interest has been in the bank for 10 days.

Western Union and Bell Telephone have both been strong during the month. The Westinghouse Electric has been holding its own and continues in advance of prices which ruled for months. It is said the company has arranged for the disposal of its World's Fair plant, which is valued at considerable above one million dollars.

The sale of the works of the National Electric Co. at Eau Claire, Wis., on Nov. 1, was attended by but few contemplating purchasers, and as a result the plant was sold for $7,500 to Peter Truax, and despite the protestations of numerous creditors the sale was confirmed by the court. A. L. Ide & Sons offered $12,000 for the plant, and the reason given why they did not attend the sale was because of an impression which had been circulated that a large figure in cash would be asked for the plant.

The two largest electric light companies of St. Louis have been consolidated in the Edison Illuminating Co., with capital of four millions and a bond issue of like amount. The companies consolidated are the Municipal Electric Light & Power Co. and the Missouri Electric Light & Power Co.

NEW BOOKS.

Poor's Directory of Railway Officials and Manual of American Street Railways, 1893, New York. H. V. & H. W. Poor. 8vo. cloth, 650 pages. Price $3.

This volume for 1893 contains a list of the officers of operating railroads in the United States and Canada, and of the chief roads of Mexico, to which has been added Poor's Index to Railway and Affiliated Industries. The book is well arranged, well bound and is a valuable book of reference.

Standard Tables for Electric Wiremen; with instructions for linemen and wiremen, underwriters rules, and useful formulae and data. By Charles W. Davis. Fourth edition, revised and edited by W. D. Weaver, New York, 1893: The W. J. Johnston Co., Ltd. Flexible morocco, 128 pages price, postpaid, $1.00.

Substantially bound and of convenient size for the pocket, this volume commends itself to the wireman even before he has opened it. The tables are standard and have been increased by the addition of tables of coefficients for alternating current wiring. The reading matter which accompanies the tables explains the use of the tables and by examples their practical use is shown. The different systems of wiring are further explained by numerous illustrations. The underwriters rules are those adopted by the Underwriters International Electric Association and have been generally accepted in the United States. The value of the book is further increased by various formulae for computing the horse power of engines and boilers; the results given are the commercial rather than the theoretical horse power.

TRADE PUBLICATIONS.

A neat little folder has been issued by the McCreary Electrical Specialty Co. It contains numerous cuts of portable electric stand lamps, desk brackets, adjustable suspended lamps and shades, and reflectors of several varieties. Prices and descriptive matter accompany the cuts, making the folder complete in every particular.

Catalogue of single valve automatic engines has been received from the J. H. McEwen Mfg. Company of Ridgeway, Pa., and catalogue of compound engines, now in press will soon be out. The different parts of the engine are described in detail, and the last few pages are devoted to a number of tables giving dimensions power, speed, indicated horse power at different speeds, pressures, etc.

The Daily Financial News, Pittsburgh, shows remarkable enterprise by s special issue of Nov. 16, which presented in an excellent manner the financial interests of Pittsburgh. The historic sketch of Pittsburgh, its institutions and prominent business men, illustrated by numerous engravings from photographs, was full of interest and shows the close relations of the News to the financial interests of that city. The issue was well supported by the business men and will undoubtedly give them good returns.

The production of trade catalogues as an art has kept pace with the great improvements that have been made in printing and engraving, so that many of the latest catalogues are in reality works of art. The catalogue just issued by the McGuire Mfg. Co., Chicago, is really a railway album. The views of American street railways are well made and interesting. The views show not only the road, cars and a glimpse of scenery but show the practical use of the McGuire trucks. The publisher ingeniously accompanies each view with a commendatory letter from the railway company and appends a list of 190 roads on which the trucks are used.

In a neat catalogue the Robins Life Guard & Mfg. Co., of Philadelphia, Pa., presents to the public its life guard or safety fender. The guard is designed for electric or cable cars and is intended to greatly reduce the lists of accidents incident to the general introduction of rapid transit. By numerous cuts the guard is shown attached to the cars and also its operation of picking up a person who has failed to get out of the way of the car. Besides the descriptions and illustrations of the guards there are numerous letters from railway managers and extracts from many prominent newspapers containing accounts of the successful operation of the guard.

Something very handsome in the catalogue line has been issued by the Ball & Wood company of New York. A neatly designed embossed cover contains 40 pages of descriptive and illustrative matter, the views showing glimpses of various parts of the engine works at Elizabeth, N.J., are fine pieces of work, and make the book interesting. The engine cuts are very clear and show to good advantage the details of the engines. The various styles of engines manufactured by the company are each shown, and the special parts are separately illustrated and described. The book is not bulky, and therein lies one of its best qualities; it presents the subject plainly without tiring the reader, and at sufficient length to cover the important details.

The Nutting arc lamp is fully described in a catalogue just issued by Bartholomew Stow & Co., Chicago. The introduction is devoted to arc lamps in general, the different principles upon which they are constructed and the special features of each lamp. The Nutting lamp is classed under a third head of "heat movement" lamps. This type, which is of recent invention, does away with the use of magnets entirely in its feeding mechanism, using instead the heat effect of current passing through a resisting conductor, an extremely simple and sensitive method of feeding. Its mechanism is described in general and in detail, illustrated by cuts and diagrams. The catalogue closes with a comparative test of arc lamps and some directions in regard to their operation.

A very nicely printed and well compiled catalogue has been issued by J. W. Penfield & Son, of Willoughby, O. "Imperial Friction Clutches" appears in gold on the rich colored cover, and the pages it encloses, which number nearly 100, are devoted to a description of the various kinds and styles of friction clutches, pulleys, and other fittings for shafting and power machinery. The tables of sizes and prices are compact and very clear. The varying loads of electric light and power houses, require the load to be shifted many times each day from one machine to another; for this purpose a number of especially designed clutches are shown in this catalogue. The size of the catalogue is desirable as it will go into a pocket, and yet is large enough so that the pages lie open while the book is being used.

PERSONAL.

Mr. Henry G. Issertel has recently opened an office at 39 Cortlandt St., New York, where he will conduct the business of an electrical middleman.

Mr. Samuel D. Cushing, recently in the expert department of the General Electric Company at the Schenectaday factory has accepted a position in the electrical department of the Chicago Insulated Wire Co. Mr. Cushing is a graduate electrical and mechanical engineer of Lehigh University and will be a valuable addition to the company's electrical force.

Mr. C. L. Pullman, contracting agent of the Pullman company, has recovered from his recent illness and his many friends will be glad to learn that he is back again at his office.

Mr. W. B. Roberts, formerly with the Rockford Electric Manufacturing Company is now the general agent of the Muncie Electrical Works, and is meeting with good success in the way of sales for his new company.

Mr. Frederic Albert Pullman, of the Pullman Electric Company, Chicago, has been confined to his home for the past week. Mr. Wm. C. Pullman is not interested in this company, his name being used in our last issue in error, instead of that of Mr. F. A. Pullman.

Mr. Geo. O. Fairbanks, for several years general agent at Chicago for the Westinghouse Electric & Manufacturing Co., has purchased an interest in the Railway Equipment Co., Chicago, and will take an active interest in the affairs of the company. In his extended business experience, Mr. Fairbanks has made many friends and acquaintances who wish him success.

BUSINESS NOTES.

Goodhue & Lincoln is the name of a new firm dealing in high grade electrical material, with offices at 1564 Monadnock Block, Chicago.

The Detroit Dynamo Co. has moved into new quarters at 121 to 125 Champlain St., Detroit, where the factory has a floor space of some 6,000 sq. ft.

The Mercer Electric Machine Co. Cincinnati, has recently been organized for the manufacture of dynamos and motors of the smaller sizes for private plants.

The Chicago Insulated Wire Company, Sycamore, Ill., has opened an office in Chicago at 207 S. Canal St., where all buyers and users of insulated wires will be welcome.

The Shawhan-Thresher Electric Co., Dayton, Ohio, is kept busy with orders for the Shawhan type of motors and dynamos. Several of these machines in operation in Dayton and vicinity are giving excellent satisfaction.

The Dallas Electric Construction Co., Dallas, Texas, of which W. A. Fraser is general manager, has just completed several electrical contracts in the state, among which is one for the equipment of the Olfenbuttel block at Tyler.

The Reliance Gauge Co., Cleveland, O., recently shipped sufficient No. 3 Reliance safety water columns to equip the boilers in the power house of the Citizens Street Railway Co., of Muncie, Ind. The company recently sold 100 columns to one company.

The Ball Engine Company, Erie, Pa., with its characteristic enterprise has commenced the building of vertical compound high speed engines. These engines have been designed with special reference to the requirements of electric lighting and power stations.

The Stephens-Miles Electric Co., Cincinnati, with P. A. Franklin, president; Edwin B. Stephens, manager; H. J. Miles, secretary and treasurer, has been organized recently to succeed The Franklin Electric Co. The new company is agent for the Jenny apparatus.

Sargent & Lundy, Chicago, who are well known in the electrical engineering field have secured the western agency for the Crocker-Wheeler motors and dynamos. Mr. J. M. Atkinson, formerly with the Westinghouse company, has joined forces with this firm and will have charge of the motor and railway branch of the business.

The Card Motor & Dynamo Co., Cincinnati, is moving into its new factory, located at the corner of Brodway and Hunt St., where the offices of the company will also be located. One of the features of the new factory will be the entire absence of shafting and pulleys, each piece of machinery being operated by its own self-contained electric motor, The new works are expected to be in full operation by Jan. 1, next.

The Great Western Manufacturing Company, is just in receipt of a stock of 50,000 pounds of H. G. weather proof wire, together with a large stock of magnet, annunciator and office wire, and is now in a position to fill large as well as small orders from its Chicago stock. The company reports that the increase in trade has necessitated carrying a larger stock in order to fill orders promptly. The company is certainly making rapid strides towards bringing Clark rubber covered wires and cables into greater demand in the west since securing the general western agency. This well known brand of wire easily passes all inspection and is named among the approved list by the Chicago and all other leading fire underwriters associations. The company reports large sales.

E. G. T. Colles & Co., 21 and 23 So. Jefferson St., Chicago has received awards on its exhibits of devices at the World's Columbian Exposition. Its improved boiler cleaning filters, live steam purifiers, exhaust steam open heaters and exhaust four cylinder pressure heaters are extensively used in power plants and this recognition of the merits of the devices are gratifying to the manufacturers as well as an evidence to the public of the character of the articles.

Phillips Insulated Wire Company, New York has just placed on the market a new "Ideal" insulated wire. The insulation, it is claimed, is superior to rubber insulation in many respects, as it will stand a very high insulation test; has a long life, not being injured by atmospheric influences and does not oxydize the copper wire. The wire is finished in several ways, plain polished black, fancy black braid (for exposed wiring), and white fireproof finish. A large demand has already arisen for this wire and satisfactory results are assured.

Commercial Electric Engineering Co., 47 Hodges Blk., Detroit, Mich., is the name of a company recently incorporated. The authorized capital is $50,000. The company will devote its attention to electrical engineering, construction and the handling of a general supply trade. The company manages the Standard system of arc lighting throughout Michigan, Ohio and Indiana. It has already secured a number of contracts for central station lighting and looks forward to a successful trade. Mr. G. E. Fisher, who has had an extended experience in this line of business, is manager of the company.

Cushing & Morse, 225 Dearborn St., Chicago, general western agents for Day's Kerite wires and cables have been sending out thousands of Morse's lightning calculators which are used not for calculating lightning but for calculating the sizes of wire which this devise does with lightning rapidity. The process is entirely mechanical. You turn the disc to the number of lamp feet nearest the desired amount and the size of wire required appears before you opposite the per cent of line loss. It is the simplest method yet devised and is so small that it takes but little room in the pocket. The center of the disc calls attention to the importance of using only wires of high grade of insulation for which Day's Kerite has an established reputation.

The Consolidated Car-Heating Co., Albany, N. Y., has made sales since its organization, August, 1889, which aggregated over one million dollars at the close of business November 4th., the exact amount being $1,003,598.89. These figures show perhaps more clearly that any other statement the progress which the company has made, and the high esteem in which its appliances are held by railroads throughout the United States and Canada. The company has just completed the equipment of the cars on the north side, and has commenced the equipment of the cars on the south side, Chicago. The heaters are favorites wherever installed, and perfect satisfaction is assured.

The Metropolitan Electric Co., Monadnock Block, Chicago, announces through a circular that besides its general supply business it will have the supervision of a factory and its entire output. The products of this factory will consist of H. T. Paiste's electrical specialties, comprising sockets, switches, porcelain goods, including rosettes, branch and main line blocks and general apparatus of this nature. The company reports an extensive sale of N. I. R. wire. A boat load of electric light carbons were recently received consisting of ½ by 12, $\frac{7}{16}$ by 12, ½ by 7 and $\frac{7}{16}$ by 7 carbons both plain and plated which they are selling at factory prices. The company is introducing the Anti-Thunder Bolt oil paper for armatures.

The Knapp Electrical Works, Chicago, is to move from its present quarters to 271, 273 Franklin St., where its facilities will be nearly doubled. New offices are to be fitted up which will compare favorably with any in the city. The upper floors will be taken up with the manufacture of the smaller specialties while the larger and heavier goods are to be manufactured at a factory some 52 miles from Chicago. The company has recently taken up the manufacture of fixtures and the designs now manufactured include the combination, electric and gas. An extensive line of these goods will be displayed in the show rooms at the new store. Among the agencies this company controls are those of the Safety Insulated Wire and Cable Co. of New York and the Columbia Incadescent Lamp Co. of St. Louis, Mo.

The Watertown Steam Engine Co., of Watertown, N. Y., is hard at work on orders received during the Exposition and at its close. During one week toward the close of the Fair the company received orders for six high speed engines at its Chicago office. Among sales during November are the following: Russellville Electric Light Co., Russellville, Ky. 40-horse power high speed aut.; Leroy Electric L. & P. Co., Leroy, Ill., 100-horse power high speed aut., Marcelline L. & P. Co., Marcelline, Mo., 100-horse power slow speed aut.; Grand Haven Light Co., Grand Haven, Mch., 40-horse power high speed aut.; C. M. Canton, Cohoes, N.Y., 40-horse power excelsior aut.; Carmi Light & Power Co., Carmi, Ill.. 140-horse power high speed aut.; Marengo Light & Power Co., Marengo, Ill., 100-horse power high speed aut.; Broadway Central Hotel, New York, 60-horse power high speed aut.; Coal City Elec. L. Co., Coal City, Ill., 100-horse power high speed aut.; Western Warehousing Co , Chicago, Ill., 80-horse power high speed aut.; Western Warehousing Co., Chicago, Ill., 200-horse power high speed aut.

Mr. J. Holt Gates, manager of the western department of the Waddell-Entz Company reports a number of recent sales, among which are a 1200 light generator direct connected to a Cooper engine running at 275 revolutions, to the Hartford Safety Deposit Building; a 1200 light generator direct connected to a Ball engine to Messrs. Willoughby, Hill & Co.; a 100-horse power railway generator run by an Ideal engine to the So., Chicago Street Railway Co.; also a 600 light dynamo direct connected to a Ball & Wood engine to the Minnesota School for the Feeble Minded at Faribault, Minn., and during the past few days orders for three 80 K. W. direct connected generators and three 30 K. W. The Waddell-Entz company are making a specialty of direct connected dynamos and generators. The Waddell-Entz copper and steel storage batteries have attracted a considerable attention and Mr. Gates reports many inquiries from the west in regard to them.

The Western Electric Company, Chicago, is making a handsome exhibit at the California Midwinter International Exposition and has already shipped seven car loads of material. It will light the Manufactures Building with 200 lights. The company is also to light the handsome tower that is being erected on the grounds in which it will make use of some novel features. Mr. E. W. Goldschmidt has just left for the exposition and is to have entire charge of the installation and take care of same during the fair. Mr. Goldschmidt will be accompanied by Chas. Wilkinson, who will go as an assistant and take care of the accounts. The company has sold the tower of light which attracted so many visitors at the Fair to John Wanamaker who is now putting it up in Philadelphia. The company will also send its World's Fair writing machine to the Beacon Electric Company, St. Paul, who are agents of the company in the northwest. The machine will be put in a new window which the company is having put in.

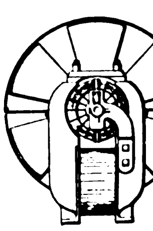
The Electric Appliance Company, Chicago, reports that its trade is highly pleased with the Packard lamp as it is now being made. The Appliance company are in receipt of unsolicited testimonials from a number of customers which are certainly very complimentary to the lamp, and which indicate that it continues to hold its place as the Packard high grade lamp with the emphasis on the high grade. The "Mogul" high candle power and "Baby" Packards are also in large demand. The Standard single push switch is something new in the line of electrical specialties which promises to find a large field. It is an improvement on the flush push switches now made in that it is operated by only a single button, instead of one button to throw on the light and one button to throw it off. In the Standard single push switch the first push throws on the light, and the second push on the same button throws it off or vice versa. The switch is thus made more compact, neater in appearance and lower in price than the double button push switches. This neat little specialty is being introduced to the western trade by the Electric Appliance Company.

The Central Electric Company, 116-118 Franklin street, Chicago, reports large sales on the various grades of P. & B. paints and varnishes, which it is handling as general western agent for the Standard Paint Company. The stock represents the different grades of these profits, put up in packages ranging from one gallon to a barrel. The sales on Anti-thunderbolt oil paper show a large and increasing demand for a product of this nature, which is absolutely reliable. This paper is a preventive for short circuits and grounds when used in winding armatures, fields and converters and is unsurpassed for electric manufacturing and repairing. It will resist the highest voltages, also the action of oil, water and dampness and the injurious action of chemicals and gases and it does not crack or tear when folded. The genuine oil paper is stamped "Anti-thunderbolt." A neat match safe, made of leather, suitable for the vest pocket and carrying a subtle but striking advertisement of "Okonite" is being distributed by the company. Besides being a striking advertisment for "Okonite," for which this company is general western agent, there is provided on the covering flap a good place for striking matches.

The Charles E. Gregory Co., 47 and 49 S. Jefferson St., Chicago, it is interesting to note, did a business during the month of November fully 50 per cent better than the same month in 1892, and that the demand for dynamos for all purposes is still very brisk. Mr. Gregory reports sales for the mouth as follows: No. 7 Brush with 25 lamps to M. Eichberg, Chicago, Ill.; M. D. 50-light Thomson-Houston arc with lamps to Rossiter, Mac Govern & Co., New York, N. Y.; 10-light Sperry arc plant to Freeman & Sons, Racine, Wis.: 7-light Excelsior arc dynamo to Turner Brass Works, Chicago, Ill.; 750-light Westinghouse alternator to Big Rapids, Mich.; 750-light Westinghouse alternator to F. S. Hubbell, Milford, Mich.; 50-light incandescent United States to G. P. Greene, Chicago, Ill.; 50-light incandescent Jenny to G. P. Greene, Chicago, Ill.. 150-light incandescent Standard to Peter Fahrney & Sons, Chicago, Ill.; 500-light incandescent Edison to A. L. Daniels, Marion, Ia.; 100-light incandescent Bain to Loeb Foundry Co., Decatur, Ill.; 360-light incandescent Edison to Saratoga Restaurant, Chicago, Ill.: 250-light incandescent United States to W. J. Acker, Bourbon, Ind.; 125-light incandescent Thomson-Houston to C. G. Arnold, Genoa, Ill.; 1 2-horse power motor to Frank Ridlon & Co., Boston, Mass.; 2 5-horse power motors to Kohler Bros., Chicago, Ill.; 12 Ward arc lamps to A. L. Daniels, Marion, Ia.; 2 Ward arc lamps to Loeb Foundry Co., Decatur, Ill.; 8 Wood double lamps to Home Electric Co., Elkhart, Ind. A brisk demand for dynamos for temporary use is also reported, and the company find this feature of the business rather profitable. Dynamos and motors of all makes and sizes can be shown in operation to intending purchasers.

CALUMET FAN MOTORS

Constructed for Business.



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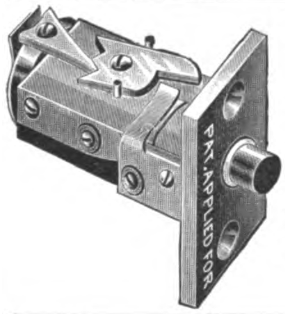

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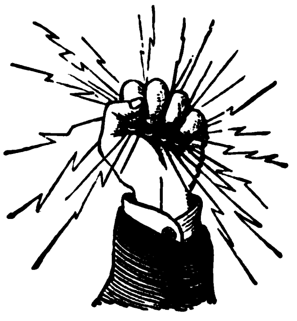

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Incandescent and Flexible Cords,

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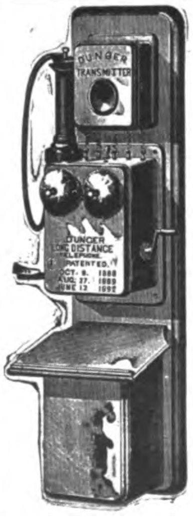

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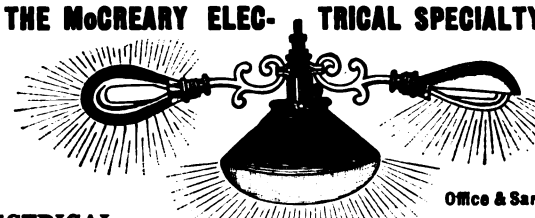

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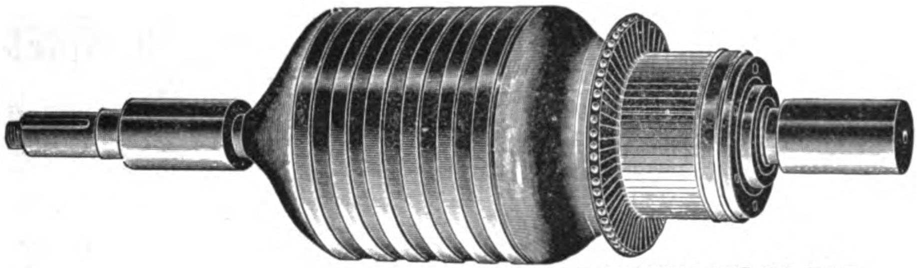

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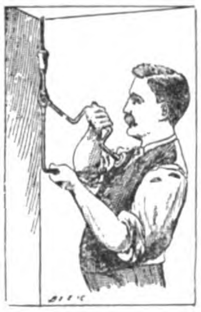

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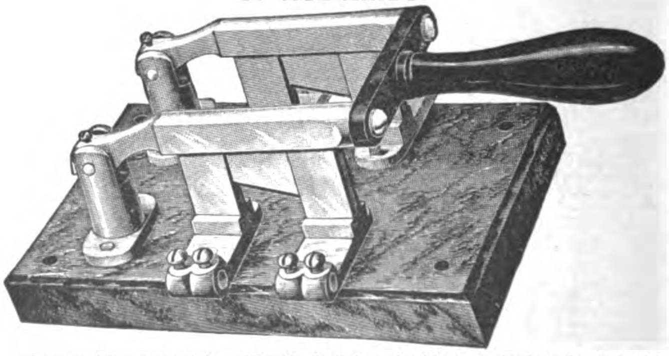

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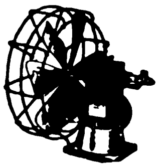

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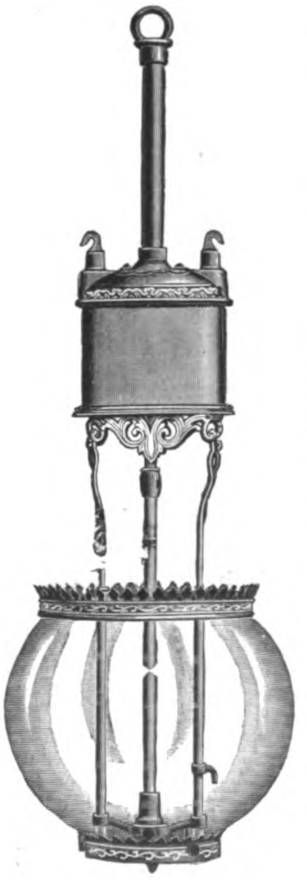

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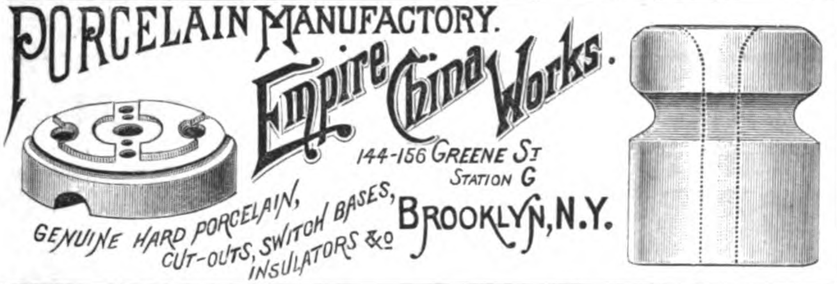
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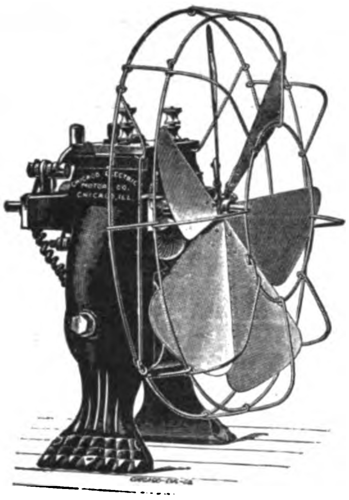

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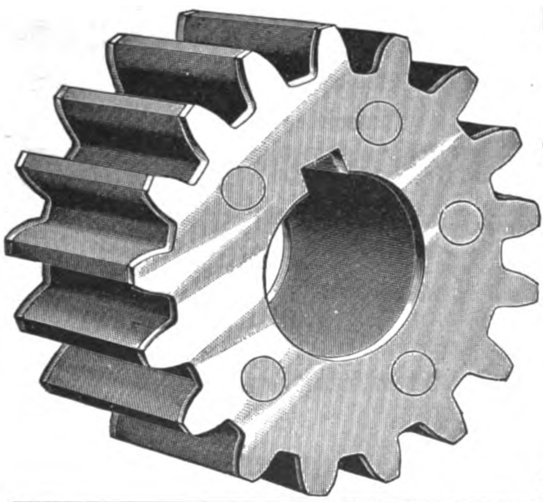

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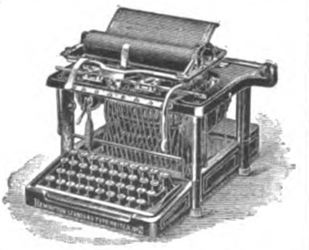

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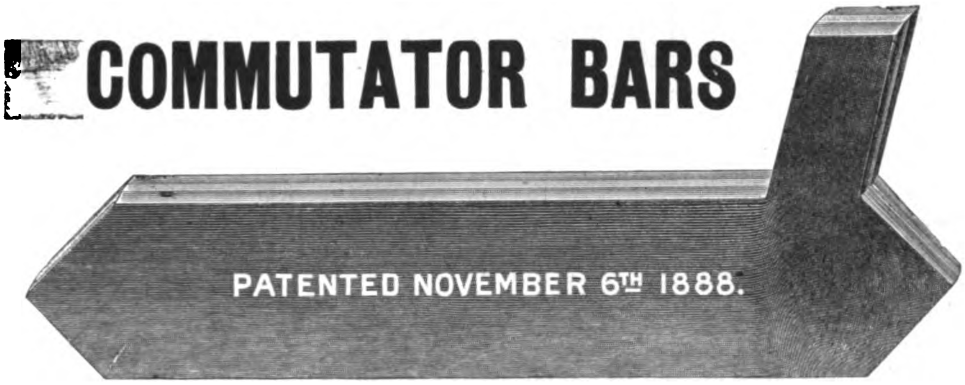
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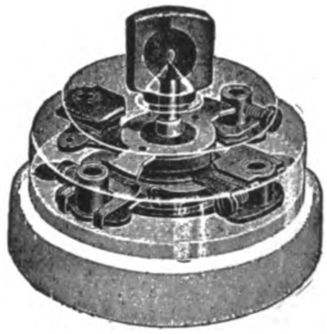

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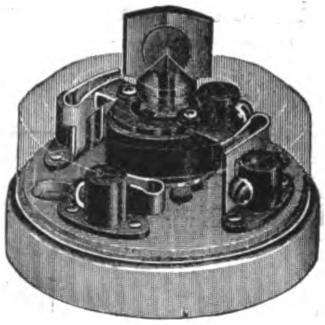

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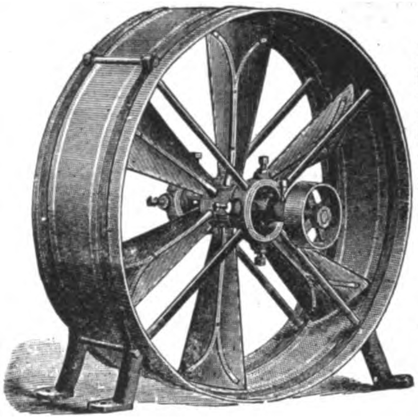

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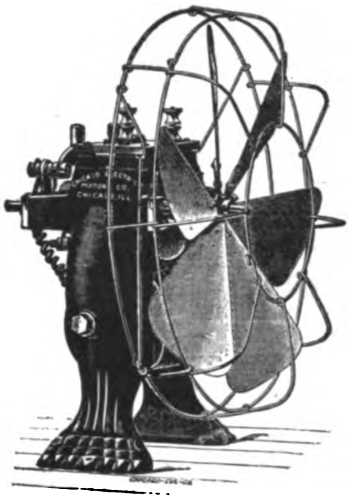

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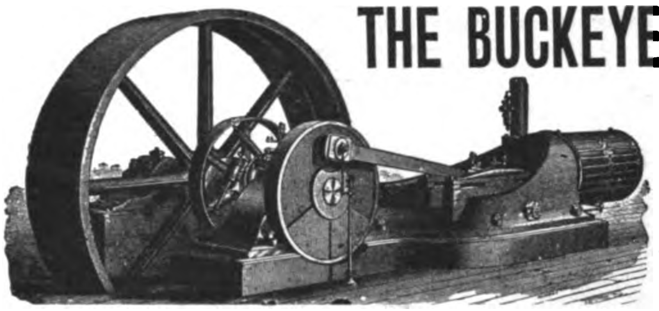

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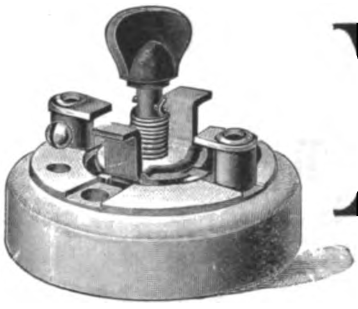

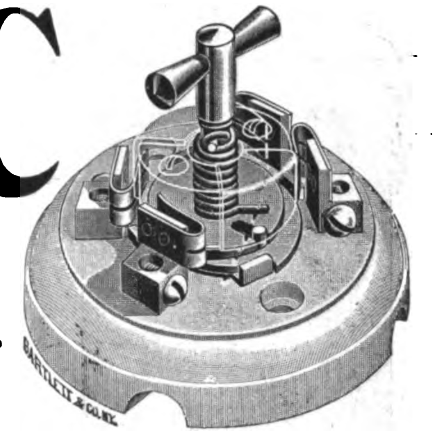

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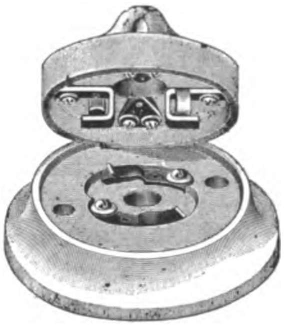

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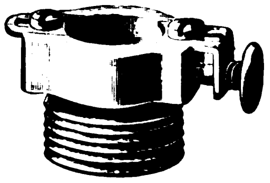

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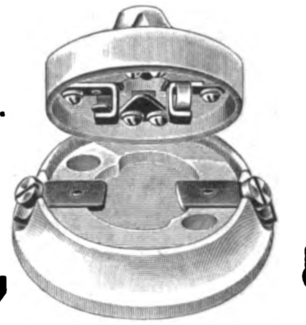

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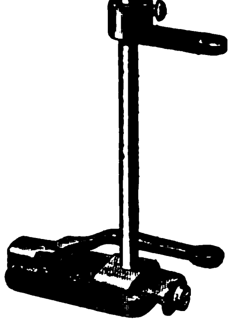

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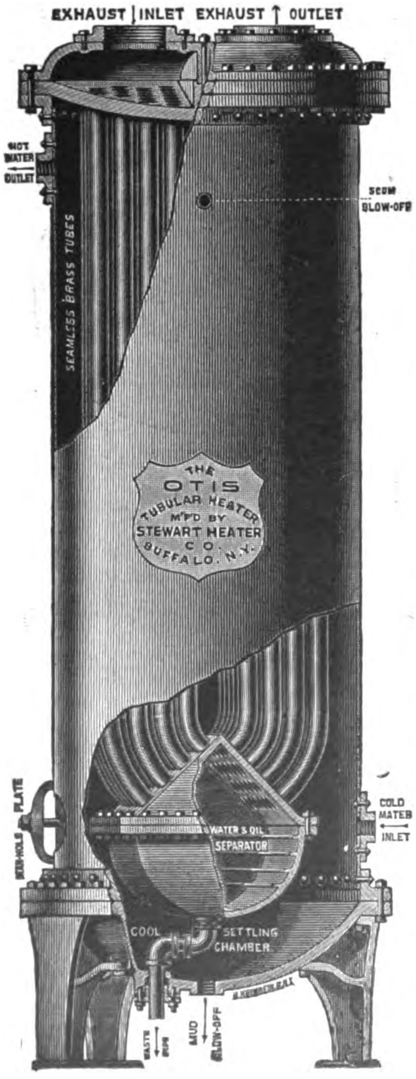

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Tubular Feed-Water Heater,

With Seamless Brass Tubes.

The Only Tubular Heater with Cool Settling Chamber Below the Tubes.

What We Guarantee.

1st. One square foot of heating surface per each horse power.
2d. To heat the feed-water to the boiling point (210 or 212 degrees) with the exhaust steam without causing any back pressure.
3d. That all the sediment that will separate at a temperature of 210 or 212 degrees will settle to the bottom of Heater in the cool settling chamber below and away from the tubes.
4th. That it will separate the water of condensation from the exhaust.
5th. That it will extract the oil that is carried over from the cylinder with the exhaust, so that the exhaust steam can be used for heating purposes, and the water of condensation be returned to the boilers without injury to them.
6th. That all trouble caused by contraction and expansion of tubes is overcome in this Heater.
7th. A larger Heater, with more heating surface (brass tubing) and water capacity than any other Heater in the market for the same money.

These Heaters are shipped on their merits, and if they fail to do all that is claimed for them, parties trying them will be to no expense, as we will pay all expense a trial has cost.

Also, Patentee and Manufacturer of Boiler Feed Pumps for continuous hard work. Also, the Red Jacket Steam Flue Blower, the most reliable Flue Blower in the market.

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STEWART HEATER CO.
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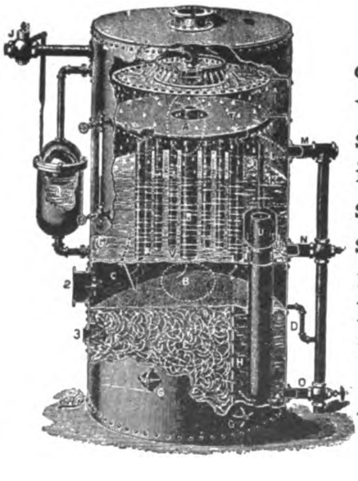
EXCELSIOR

Feed Water Heater,
Purifier, Filter and
Oil Separator Combined



Maintains a temperature of 204 to 212 degrees F. without back pressure, absolute guarantee to eliminate oil from the exhaust steam. Sold on trial, with strict guarantees. Over 150,000 H.-P. in use in largest power plants in the U. S.

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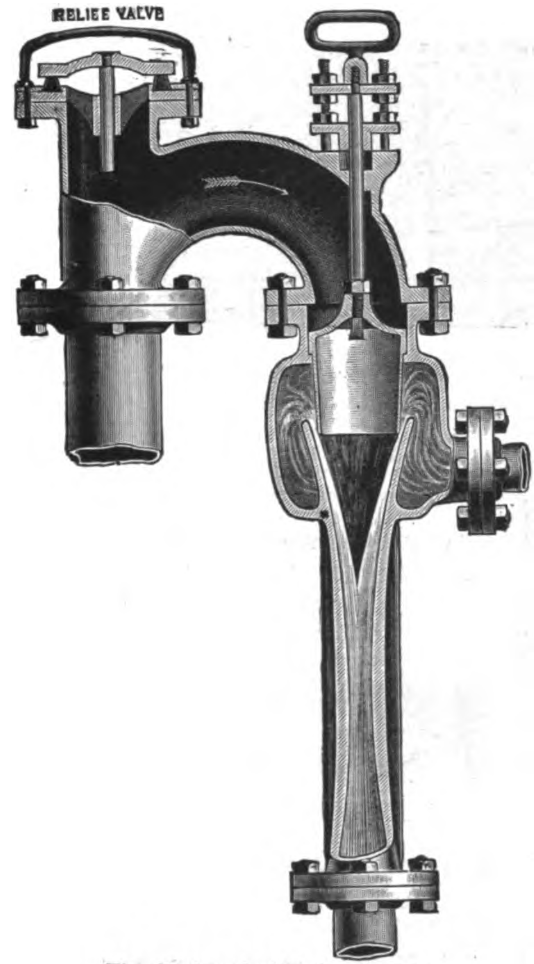

The Water Jacket Condenser.

MANUFACTURERS OF

Feed Water
Heaters,
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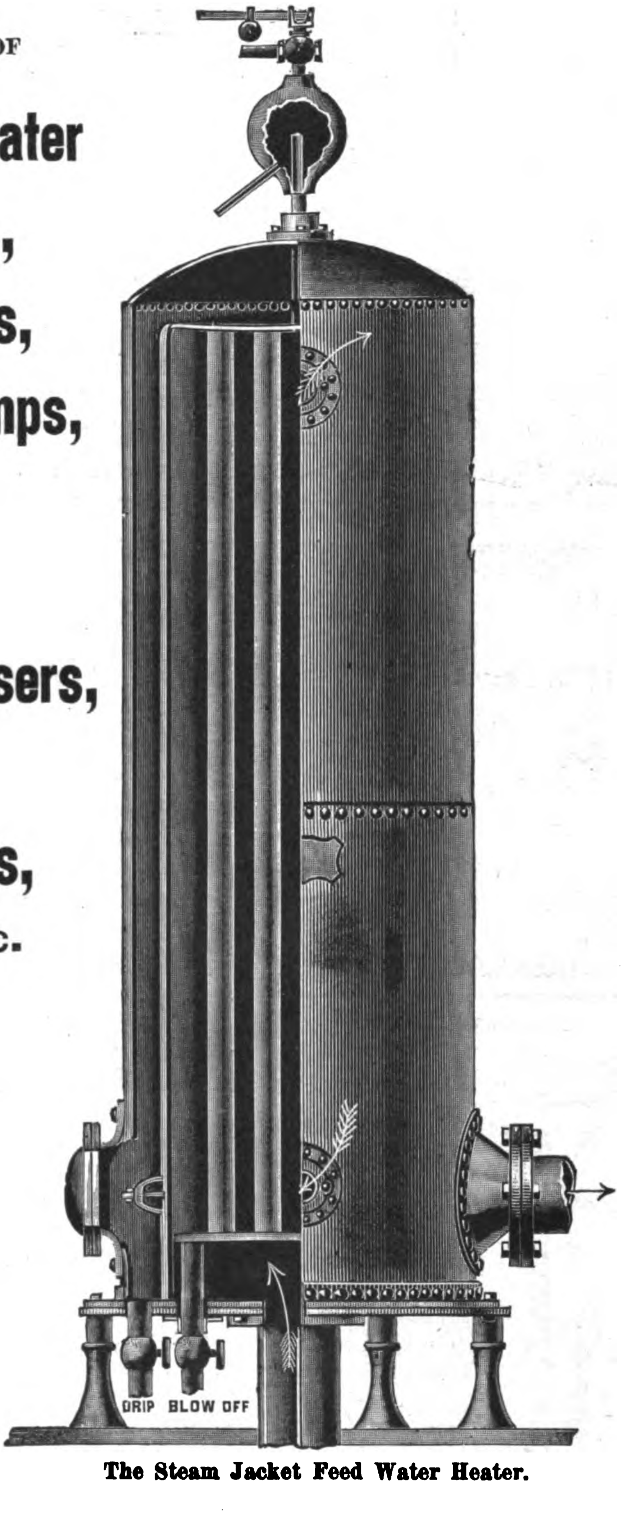
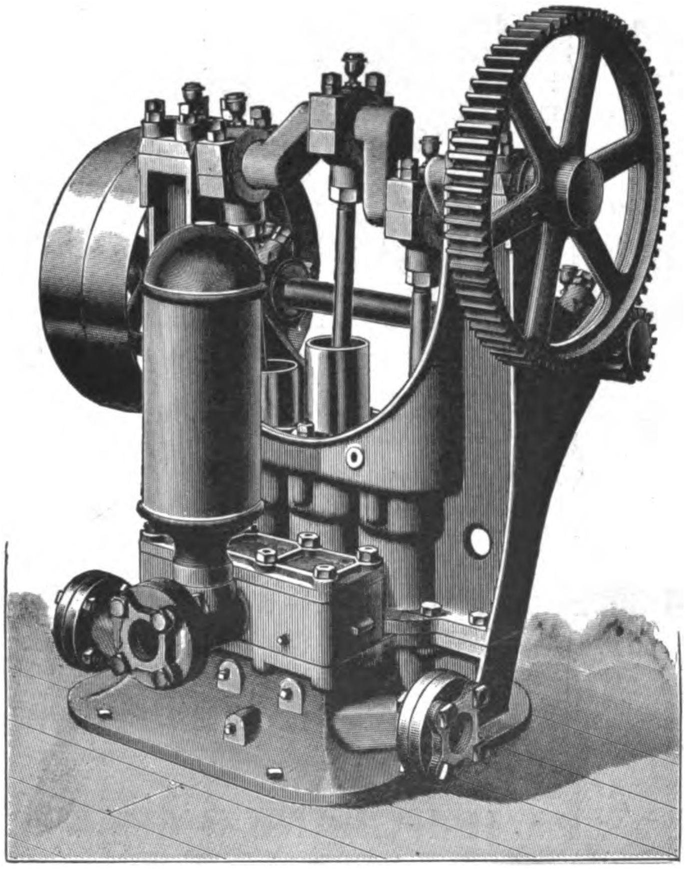


The Steam Jacket Feed Water Heater.



The Triple-Acting Power Boiler Feed Pump.

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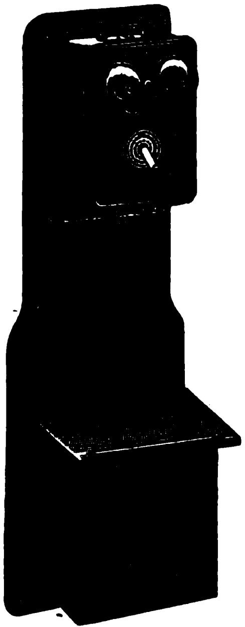

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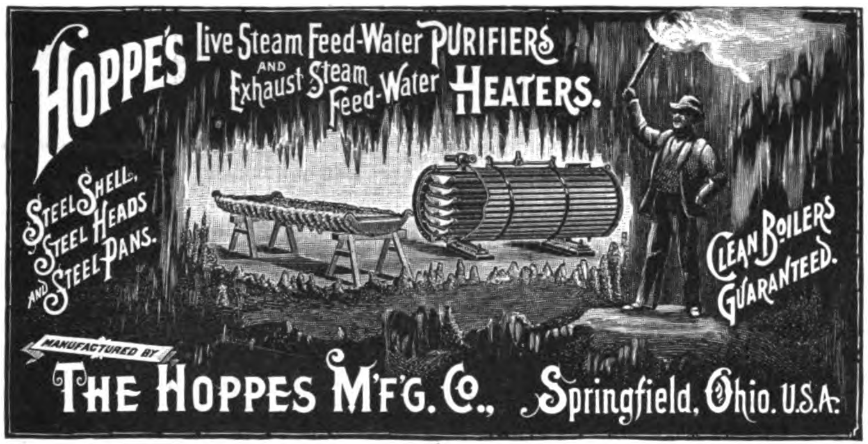
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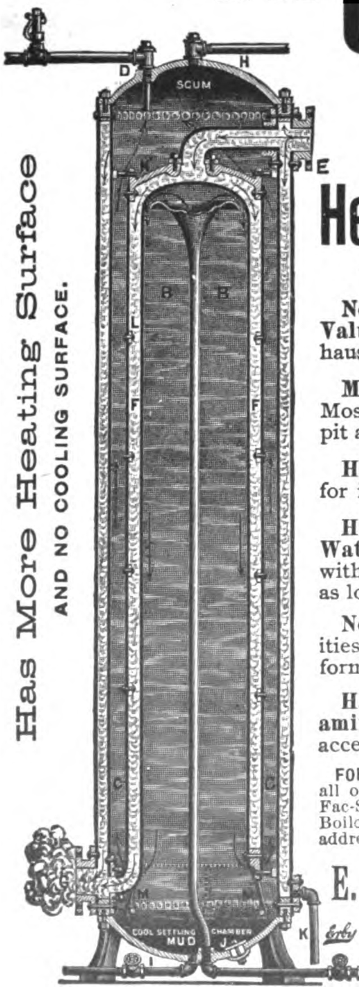
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10,000 H. P. IN USE.

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Made **of Four Steel Cylinders.** Most durable; no tubes to loosen, pit and leak.

Has a **Cool Settling Chamber** for impurities.

Holds **Four Times as Much Water**, which remains in contact with the heating surface four times as long.

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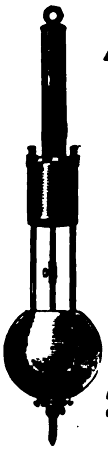

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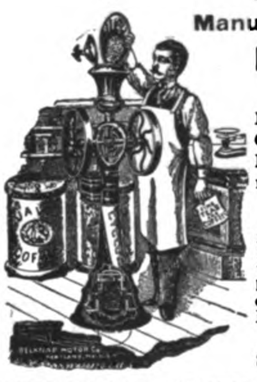

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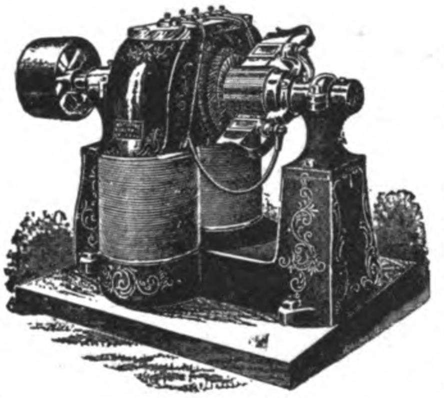

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Special Reversible Elevator Motors. Also Automatic Motors.

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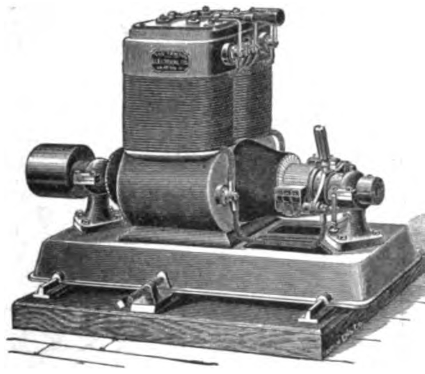

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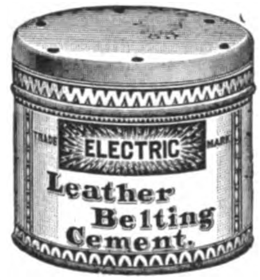

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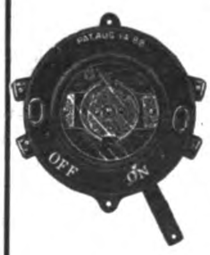

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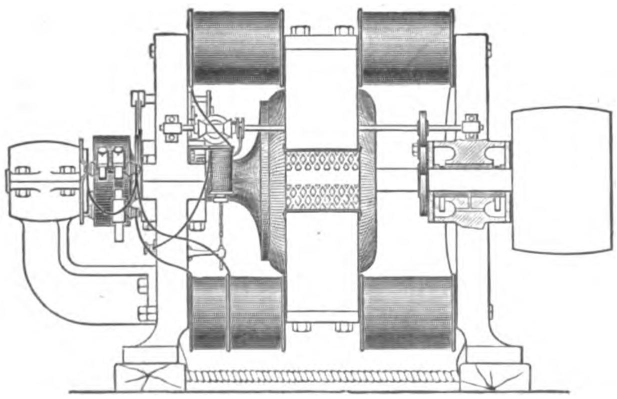

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